United States
Department of
Agriculture

Cost Estimating Guide for Road Construction

Forest Service
Northern
Region
Engineering

February 2011

For document information contact: Brenda Christensen, bchristensen@fs.fed.us, (406) 329-3351

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DIVISION 100 GENERAL REQUIREMENTS

Conversion Tables of Weights and Measures

Linear Measure

1 inch		= 2.54 centimeters
12 inches	= 1 foot	= 0.3048 meter
3 feet	= 1 yard	= 0.9144 meter
5 1/2 yards 16 1/2 feet	= 1 rod (or pole or perch)	= 5.029 meters
40 rods	= 1 furlong	= 201.17 meters
8 furlongs 1,760 yards 5,280 feet	= 1 (statute) mile	= 1,609.3 meters
3 miles	= 1 (land) league	= 4.83 kilometers

Square Measure

1 square inch		= 6.452 square centimeters
144 square inches	= 1 square foot	= 929 square centimeters
9 square feet	= 1 square yard	= 0.8361 square meter
30 1/4 square yards	= 1 square rod = square pole = square perch	= 25.29 square meters
160 square rods 4,840 sq yards 43,560 sq ft	= 1 acre	= 0.4047 hectare
640 acres	= 1 square mile	= 259 hectares = 2.59 sq kilometers

Cubic Measure

1 cubic inch		= 16,387 cubic centimeters
1,728 cubic inches	= 1 cubic foot	= 0.0283 cubic meter
27 cubic feet	= 1 cubic yard	= 0.7646 cubic meter
16 cubic feet	= 1cord foot	
8 cord feet	= 1 cord	= 3.625 cubic meters

Dry Measure

1 pint		= 33.60 cubic inches	= 0.5505 liter
2 pints	= 1 quart	= 67.20 cubic inches	= 1.1012 liters
8 quarts	= 1 peck	= 537.61 cubic inches	= 8.8096 liters
4 pecks	= 1 bushel	= 2,150.42 cubic inches	= 35.2383 liters

1 British dry quart	= 1.032 U.S. dry quarts

Liquid Measure

1 gill	= 4 fluid ounces	= 7.219 cubic inches	= 0.1183 liter
4 gills	= 1 pint	= 28.875 cubic inches	= 0.4732 liter
2 pints	= 1 quart	= 57.75 cubic inches	= 0.9463 liter
4 quarts	= 1 gallon	= 231 cubic inches	= 3.7853 liters

The British imperial gallon (4 imperial quarts) = 277.42 cubic inches = 4.546 liters.
The barrel in Great Britain equals 36 imperial gallons, in the United States, usually 31 1/2 gallons.

Avoirdupois Weight

1 dram or 27.34 grains		= 1.772 grams
16 drams or 437.5 grains	= 1 ounce	= 28.3495 grams
16 ounces or 7,000 grains	= 1 pound	= 453.59 grams
100 pounds	= 1 hundredweight	= 45.36 kilograms
2,000 pounds	= 1 ton	= 907.18 kilograms

The grain is equal to 0.0648 gram

In Great Britain, 14 pounds (6.35 kilograms) = 1 stone, 112 pounds (50.80 kilograms) = 1 hundred weight, and 2,240 pounds (1,016.05 kilograms) = 1 long ton.

THE METRIC SYSTEM

Linear Measure

10 millimeter	= 1 centimeter	= 0.3937 inch
10 centimeters	= 1 decimeter	= 3.937 inches
10 decimeters	= 1 meter	= 39.37 inches or 3.28 feet
10 meters	= 1 decameter	= 393.7 inches
10 decameters	= 1 hectometer	= 328 feet 1 inch
10 hectometers	= 1 kilometer	= 0.621 mile
10 kilometers	= 1 myriameter	= 6.21 miles

Square Measure

100 square millimeters	= 1 square centimeter	= 0.15499 square inch
100 square centimeters	= 1 square decimeter	= 15.499 square inches
100 square decimeters	= 1 square meter	= 1,549.9 square inches = 1.196 square yards
100 square meters	= 1 square decameter	= 119.6 square yards
100 square decameters	= 1 square hectometer	= 2.471 acres
100 square hectometers	= 1 square kilometer	= 0.386 square mile

Land Measure

1 square meter	= 1 centiare	= 1,549.9 square inches
100 centiares	= 1 are	= 119.6 square yards
100 ares	= 1 hectare	= 2.471 acres
100 hectares	= 1 square kilometer	= 0.386 square mile

Volume Measure

1,000 cubic millimeters	= 1 cubic centimeter	= .06102 cubic inch
1,000 cubic centimeters	= 1 cubic decimeter	= 61.02 cubic inches
1,000 cubic decimeters	= 1 cubic meter	= 35.314 cubic feet

Weights

10 kilograms	= 1 myriagram	= 22.046 pounds
10 myriagrams	= 1 quintal	= 220.46 pounds
10 quintals	= 1 metric ton	= 2,204.6 pounds

General Information and Instructions

Revisions and Updates. A review of the Cost Guide is conducted annually. Adjustments will be made if necessary. Revisions to the Cost Guide will be published in February.

Specifications and Section Numbers. The Cost Guide has been written using FP-03 (Standard Specifications for Construction of Roads and Bridges on federal Highway Projects) and FSSS (Forest Service Supplemental Specifications) as work item descriptions. The Specifications are referred to by Section Numbers. Supplemental Specifications are referred to by Forest Service Supplemental Specifications (FSSS). The FSSS's replace or modify the parent specification.

Time and Equipment (Constructive) Estimates. On some items, it may be necessary to develop estimates by "time and equipment." When making time and equipment estimates, be sure to include allowances for:

- **Supervision.** On very small jobs this may be provided by an operator/supervisor at essentially no additional cost.
- **Taxes** on purchase of material.
- **Bonding** cost (may be included in Section 151).
- **"Standby time"** for equipment and operators that are part of a "spread" performing a segment of work, but who are not working at full capacity all the time, averages 2 to 2 1/2 of the total contract cost (do not include bonding on timber sales). For example, during placement of aggregate, a grader, roller and water truck are needed. The grader and roller may be operating full time; the water truck only part time. The estimate should include standby time for the water truck to compensate for having it available on the job during the entire time of placing aggregate.
- **Support Equipment** - fuel trucks, pickups, crew transportation, etc.
- **Permits**.

Please note that the labor and equipment rates shown in the Cost Guide include applicable "payroll loading" and profit and overhead.

Unit Costs. To ensure compatibility with the Spreadsheet for Preparation and Administration of Road Contracts (SPARCS), unit costs must be at least rounded to the nearest whole cent ($0.01); however, the estimator should attempt to round off the unit price to the nearest significant figure. For example, clearing costs generally should be rounded to the nearest $10 or $25 per acre, excavation costs should be rounded to the nearest $.01 per cy, and CMP costs are rounded to $.50/LF. Quantities should never be carried out further than the nearest one-hundredth (0.01), and generally no further than the nearest one-tenth (0.1), depending on accuracy of measurements and cost or value of the item.

Use of Average Cost in Project. Use average cost for individual roads within the project whenever possible unless there are significant variations in the character of work from one road to another. Variations are sometimes appropriate for clearing, excavation, hauling, or other unique situations. In these situations, each road should have separate and distinct unit costs for those items; otherwise, the use of overall project unit costs may create problems with design changes, alternate facilities, etc.

Profit and Risk Factor. The profit and risk factor used in this Cost Guide is 6 percent. All unit prices shown in the Guide include this allowance, including the equipment rates (Table 622). Payroll overhead costs of 10 percent are used in all rates in addition to the 6 percent profit and risk factor.

Time Estimates. In accordance with Section 52.212-3 of the Federal Acquisition Regulations (FAR's), contract time for public works contracts must be calculated based on a continuous run of contract time. The contract time must include an estimate of the winter shutdown time. If the midpoint of construction is computed, it should be based on the midpoint of work or the midpoint of estimated cash flow, not the midpoint of contract time.

Public Works & Timber Sale Estimates. All engineer's estimates for road construction, with the exception of allowances for quality control, are to be prepared as if construction is to be accomplished by a public works contract. Quality control policy for timber sales may change after Guide is published.

Davis-Bacon (D-B) /Purchaser Wage Rate Adjustments: To arrive at Specified Road Construction Cost, the engineer's cost estimate shall be adjusted by the estimated cost difference between the applicable Davis-Bacon wage rates and the local prevailing wage rates using the appropriate labor factor given for the labor percentages shown for each work item. These adjustments are mandatory and will be used for all timber sale contracts having specified road construction. Note that some work items are not normally performed by a Timber Sale Purchaser but are subcontracted. No reduction should be made for these items, if the subcontractor is likely to pay Davis-Bacon wage rates. Reductions will be made for those situations where it is unlikely that D-B wages are paid. Refer to FSH 7709.56-7.54 (Preconstruction Handbook) for more information, and refer to Labor Rates in back of this Guide for D-B wage information. An example of this may be dust palliative treatments. For additional information, see section entitled Davis-Bacon/Purchaser Wage Rate Adjustments.

Fuel Prices. Fuel costs can be quite variable over a period of time due to geopolitical conditions. Equipment prices in this Guide may need to be adjusted by the estimator to compensate for these variations. Other machinery/equipment that uses fuel or propane such as asphalt plant dryers, generators, etc. may also cost more/less to operate. The overall effect on the typical road construction project is that 30-40% fuel price increases will increase the total cost of construction about 2-5%. The estimator should be aware of big (10% plus) fuel price increases/decreases that would affect the unit bid prices shown in this Guide. Fuel price variations will have more effect on items that are equipment oriented such as excavation, than those that are material and labor oriented such as signs.

Contractor Quality Control (QC) and Quantity Measurement. Section 153 is for use on Capital Investment and 14i (turnback) contracts; costs are to be subsidiary to their associated pay items. Do not have a separate pay item for quality control. Please note that R-1's FSSS for Section 160 outlines the frequency of sampling and testing and are mandatory for public works road contracts. R-1 FSSS 105 is required for timber sales which have aggregate surfacing, and does have some measurement and sampling requirements. Estimating procedures and unit costs for contractor QC are outlined in Section 153 of this Guide. Estimator is reminded to stay current with policy regarding timber sale QC requirements.

Midpoint of Construction. The midpoint for construction for unit costs shown in the bid summary in this Guide is estimated to be April. Until further notice, no adjustments to unit costs for inflation will be calculated.

Use of Costs Other Than Shown in the Cost Guide. When local experience indicates unit costs are different than those shown in this Guide, local costs should be considered. Cost deviations from this Guide shall be documented and included in the project file.

Small Quantity Adjustments. Estimates should consider all roads that are included in a contract package that are within a five mile radius as one project for the purposes of small quantity adjustments. Therefore, small quantity factors should not be applied to individual road costs when the individual

roads are part of a larger group of road projects in the same vicinity and part of the same contract. On the other hand, where small quantities are involved, estimators should increase allowances due to the inefficiencies generally encountered in small projects. Of particular concern, are projects where small quantities of aggregate are involved. Mobilization of equipment may outweigh the direct costs of the aggregate, short road construction projects also have a relatively high mobilization cost for transport of dozers and excavators.

Signs. On public works contracts, the contract should require the contractor to furnish and install all signs in accordance with the project sign plan. For 14i (turnback) and timber sale contracts, Regional policy (FSM 7720 supplement) may be revised which will require the furnishing and installation of regulatory and warning signs by the timber purchaser. However, at the date of publishing, existing policy has not been revised. Current policy is that signs for closure devices (gates, barricades, etc.) on timber sale projects (including 14i contracts) are considered as a part of the closure device and should be furnished and installed by the purchaser (or 14i contractor), this includes advance warning signs for such closures. Route markers are part of the road work and are furnished by the purchaser (mile markers are also required road work signs). Other necessary regulatory/warning signs are to be furnished by the Government and installed by the purchaser (14i contractor).

Purchaser Engineering. Recent changes in Forest Service FRP budgets have introduced or revised several concepts for timber sale roads: post-award engineering (PAE) including possible purchaser survey and/or design, restricted public use of haul routes, deposits for engineering work on road reconstruction, converting some planned short-term specified roads to temporary roads that remain open for a short period after purchasers use, and use of salvage sale funding for engineering work. Estimator should refer to specific C-provision requirements when estimating purchaser engineering costs.

Change Orders & Design Changes. The principles, costs, etc. listed in this Guide can be used to assist in determining unit costs for contract design changes and change orders; however, site specific and project related information should be used to the maximum extent possible.

North Dakota / South Dakota / Washington. Costs estimates for road construction in these States should be adjusted by local equipment and material costs, applicable Davis-Bacon wage rates, and local labor rates. The costs in this Guide are oriented to activity in Idaho and Montana.

FP-03 Specifications. All cost in this guide are associated with the FP-03 and FSSS specifications. Specifications may change and users of this guide should verify that the costs are associated with the correct type of work.

Storm Water Permitting. EPA regulations require permits for road construction activity with more than 5 acres disturbance except in Montana where the disturbance is 1 acre, or rock pits and quarries. Timber sale road construction is exempt from the regulations, but rock pits or quarries for timber sale roads must be permitted.

Permit regulating agency by State:

- Idaho: EPA
- Montana: Water Protection Bureau
- South Dakota: Department of Environmental and Natural Resources
- North Dakota: Division of Water Supply and Pollution Control.

Permits must be obtained by the contractor before construction begins. Fee's may apply. Consult permit regulating agency for cost estimating permit fees.

Montana Stream Protection Act (SPA 124) and 318 Authorization Permits. SPA 124 permits issued by the Montana Department of Fish, Wildlife and Parks are required for any project including the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries. There is a 60 day review period. There is no application fee.

Any activity in any state water that will cause unavoidable short term violations of water quality standards will require a 318 Authorization Permit. The 318 permits are administered by the Montana Department of Environmental Quality with an application fee may apply. Usually 30 to 60 day review period.

Internet. The cost guide can be found on the Forest Service Northern Region internet by navigating through *Working Together*, *Contracting*, *Cost Estimating Guide for Road Construction*. If you do not have access to a computer and the internet, you can request a copy from U. S. Forest Service, Region One, Engineering.

Summary. This is a guide and not a cookbook. Estimators need to use judgement and knowledge of the specific project and local conditions when preparing cost estimates.

End of Division 100 General Rquirements

ENGINEER'S ESTIMATE

ENGINEER'S ESTIMATE

The preliminary estimated unit costs may need to be adjusted. Determine the area and/or zone and adjust the unit costs per instructions of this section.

DETERMINATION OF WAGE RATE AREA/ZONE

IDAHO

Area 1. The portion of Region 1 that lies in Idaho with the exception of that portion of Idaho county that lies south of the 46th parallel is in Area 1

Note: Area 1 has been expanded to two zones which is being defined by the distance from the Post Offices in Spokane, Pasco, Washington, and Lewiston, Idaho.

Zone 1: Within 45 radius miles from the main Post Office
Zone 2: Outside 45 radius miles from the main Post Office

Area 2. The portion of Region 1 that lies in Idaho County and south of the 46th parallel is in Zone 2 of Area 2. This includes most of the Nez Perce National Forest. Therefore all reference in this guide to Area 2 is for Zone 2 of that Area. (Zone 1 lies in the southern part of Area 2 and is a 60 mile (97 kilometers) wide strip following I-84, I-86, and part of I-15.)

Zone 2: Idaho County south of the 46th parallel

MONTANA

In Montana there are three (3) wage rate zones based on the shortest practical route over maintained roads from the center of the project to the nearest County Court House located in the following listed towns:

Billings	Glasgow	Helena	Miles City
Bozeman	Glendive	Kalispell	Missoula
Butte	Great Falls	Lewistown	Sidney
Dillon	Havre		

The zones are defined as:

Zone 1:	0-30 miles
Zone 2:	30-60 miles
Zone 3:	over 60 miles

NORTH DAKOTA / SOUTH DAKOTA / WASHINGTON

Adjust the preliminary unit costs by applicable Davis-Bacon wage Area and/or Zone differential. Contact the Regional Office for necessary data.

ADJUSTMENT FACTORS FOR THE UNIT COSTS

Adjust the preliminary estimated unit prices by multiplying them by the appropriate factor in the following table. The factors are based on the appropriate Davis Bacon wage rates with fringes and overhead loading for a mixed work force of equipment operators, laborers, and truck drivers.

Adjustment Factor for Public Works Davis-Bacon Zones

LABOR %	IDAHO AREA 1 ZONE 1	IDAHO AREA 1 ZONE 2	IDAHO AREA 2 ZONE 2	MONTANA ZONE 1	MONTANA ZONE 2	MONTANA ZONE 3
5	1.00	1.00	1.00	0.99	1.00	1.00
10	0.99	1.00	1.00	0.99	1.00	1.00
15	0.99	1.00	1.00	0.98	0.99	1.00
20	0.99	1.00	1.00	0.98	0.99	1.00
25	0.99	1.00	1.00	0.97	0.99	1.00
30	0.98	1.00	1.00	0.96	0.99	1.00
35	0.98	1.00	1.00	0.96	0.98	1.00
40	0.98	1.00	1.00	0.95	0.98	1.00
45	0.98	1.00	1.01	0.95	0.98	1.00
50	0.97	1.00	1.01	0.94	0.98	1.00
55	0.97	1.00	1.01	0.93	0.98	1.00
60	0.97	1.00	1.01	0.93	0.97	1.00
65	0.96	1.00	1.01	0.92	0.97	1.00
70	0.96	1.00	1.01	0.92	0.97	1.00
75	0.96	1.00	1.01	0.91	0.97	1.00
80	0.96	1.00	1.01	0.90	0.96	1.00
85	0.95	1.00	1.01	0.90	0.96	1.00
90	0.95	1.00	1.01	0.89	0.96	1.00
95	0.95	1.00	1.01	0.89	0.96	1.00
100	0.94	1.00	1.01	0.88	0.95	1.00

Examples

Example No. 1:

Idaho, Area 1 (Zone 2)
18" culvert (new construction)
Percent labor = 25%
Cost Guide unit cost = $22.00/lf
Area 1 unit cost = $22.00 x 1.00 = $22.00/lf no adjustment.

Example No. 2:

Idaho, Area 1 (Zone 1)
18" culvert
Percent Labor = 35%
Cost Guide unit cost = $22.00/lf
Area 2 unit cost = $22.00 x 0.98 = $21.56/lf rounded.

Example No. 3:

Montana, Zone 3
18" culvert
Percent Labor = 25%
Cost Guide unit cost = $22.00/lf
Zone 3 unit cost = $22.00 x 1.00 = $22.00/lf rounded

End of Engineer's Estimate

DAVIS-BACON/PURCHASER WAGE RATE ADJUSTMENTS

Davis-Bacon/Purchaser Wage Rate Adjustments

All projects must first be estimated as if being built by public works contracts with respect to Davis-Bacon wage rates. For Timber Sale Contracts, the engineer's estimate must then be adjusted by the difference between Davis-Bacon and local wage rates to determine the Specified Road Cost (Specified Road Construction Cost plus augmentation if any).

The following labor percentage ranges are typical and include equipment operator, truck drivers and laborers. The actual percentage selected should be documented. Use of percentages different than those indicated and the reason for the selection should also be documented.

LABOR PERCENTAGE RANGES

Work Item	Labor % Range	Low Percent Factors	High Percent Factors
Clearing & Grubbing	20-55	Small or scattered timber, light ground cover gentle terrain, scattering	Large timber, "doghair", heavy ground cover, rugged terrain, piling & burning
Excavation	20-45	Gentle terrain, good soils, easy construction, wide tolerance, sidecast type construction	Rugged terrain, poor soils and rock, difficult construction, rip/ blasting, close tolerances, end-haul
Base and Surfacing	30-50	Crushed pit rock, wide gradation tolerance	Crushed quarry rock, close gradation tolerance
Asphalt	20-40	Large project, road mix, wide tolerance, surface treatments	Small project, plant mix, close tolerance, labor intensive
Mobilization	20-40	Minimum labor required on project preparation	Project preparation is very labor intensive
Culverts	30-60	Flat slopes, soil with little rock, minimal labor requirements, small dia, dry	Steep slopes, soil with large amount of rock, labor intensive, large dia, wet
Stabilization	35-70	Hydromulch, flatter slopes, large projects	Hand placed mulch, multiple processes, steeper slopes, small projects

See individual items in text of Cost Guide for other labor percentages. Note that contract items (items not normally accomplished by woods crews such as engineering and asphalt items) are not to be reduced, if the subcontractor is expected to pay Davis-Bacon wage rates. See Labor Rates in the back portion of this Guide for D-B wage rate information.

To determine the Specified Road Construction Cost allowance for any item, the following procedure must be followed:

- Determine the Davis Bacon wage rate area and/or zone. For instructions, see the previous section of this guide, Engineer's Estimate.
- Determine labor percentage for applicable item in the body of this Guide or from the LABOR PERCENTAGE RANGES table on the previous page.
- Select the appropriate labor factor from the ADJUSTMENT FACTOR FOR WAGE DIFFERENTIALS chart.
- Determine Specified Road Construction Cost for applicable item **by dividing** the public works cost by the labor factor determined from the ADJUSTMENT FACTOR FOR WAGE DIFFERENTIALS chart.

Adjustment Factor for Wage Differentials

LABOR %	IDAHO AREA 1 ZONE 1	IDAHO AREA 1 ZONE 2	IDAHO AREA 2 ZONE 2	MONTANA ZONE 1	MONTANA ZONE 2	MONTANA ZONE 3
5	1.01	1.01	1.01	1.01	1.02	1.02
10	1.02	1.02	1.03	1.03	1.03	1.03
15	1.03	1.04	1.04	1.04	1.05	1.05
20	1.04	1.05	1.05	1.05	1.06	1.07
25	1.05	1.06	1.07	1.07	1.08	1.09
30	1.06	1.08	1.08	1.08	1.10	1.11
35	1.07	1.09	1.10	1.09	1.12	1.13
40	1.08	1.11	1.11	1.11	1.14	1.16
45	1.10	1.12	1.13	1.12	1.16	1.18
50	1.11	1.14	1.14	1.14	1.18	1.20
55	1.12	1.15	1.16	1.16	1.20	1.23
60	1.13	1.17	1.18	1.17	1.22	1.25
65	1.15	1.18	1.19	1.19	1.25	1.28
70	1.16	1.20	1.21	1.21	1.27	1.31
75	1.17	1.22	1.23	1.22	1.30	1.34
80	1.19	1.24	1.25	1.24	1.32	1.37
85	1.20	1.26	1.27	1.26	1.35	1.40
90	1.21	1.28	1.29	1.28	1.38	1.43
95	1.23	1.30	1.31	1.30	1.41	1.47
100	1.24	1.32	1.33	1.32	1.44	1.51

Example:

Public Works Excavation cost = $1.75/cy
Project Location: Idaho, Area 1 (Zone 1)
Excavation: labor percentage = 25 percent
labor factor = 1.05
Specified road construction cost = $1.75/1.05 = 1.67/cy

End of Davis-Bacon/Purchaser Wage Rate Adjustment

TIME ESTIMATES & CALCULATION OF MIDPOINT OF CONSTRUCTION

Time Estimates and Calculation of Midpoint of Construction

Even though there is no adjustment factor for inflation in this Cost Guide, care must be exercised when determining time estimates. The final time estimate should not be made until all contract clauses are known, including applicable C clauses for timber sale contracts. Be sure to consider operating season limitations. Project access and sequencing must also be considered.

Except in unusual circumstances, the time estimate shall not exceed two (2) full construction seasons. This may require increasing the size of the crew and the amount of equipment used in the estimate. In addition, this may require the adjustment of some cost items and contract clauses. Time estimates in excess of two full construction seasons shall be justified, documented, and approved by the Forest Engineer.

The midpoint of construction for estimating purposes is the cost weighted average of incremental construction periods or construction items. Midpoint may be determined by analyzing the project as a whole or by analyzing individual construction items or groups of related construction items.

Due to the requirements of the Federal Acquisition Regulations (FAR's), it is essential that the midpoint be computed based on the midpoint of work or estimated cash flow, not the midpoint of contract time. FAR 52.212-3 requires that contract time be established to include estimated winter shutdowns. Contract time will continue to count through the winter season.

The remainder of this section contains two examples of determining the midpoint of construction followed by two forms. The first form may be used in calculating the midpoint of construction, and the second for use in determining the number of contract days.

Example 1: Analyzing Incremental Construction Periods

(Note: Example and must be modified using the correct dates.)

Advertise	May 1, 2002	Work Season	May 15 - Nov 15
Open Bids	June 2, 2002	Total Work Days	200
Contract Award	June 15, 2002	Completion Date	July 15, 2003
Start Work	July 1, 2002	Project Cost	$300,000

	Date	Calendar Day	Project Day
Start Work 2002 Season:	Jul 1	182	1
Suspend Work 2002 Season by:	Nov 16	320	138
Resume Work 2003 Season:	May 15	135	318
Complete Work 2003 Season before:	Jul 16	197	381

2002 Season	= 138 - 1	= 137 Work Days
Shutdown	= 318 - 138	= 180 Days
2003 Season	= 381 - 318	= 63 Work Days

Total Work Days = 2002 Season (137 days) + 2003 Season (63 days)	= 200 Days
Contract Days = Work Days + Winter Shutdown = 200 + 180	= 380 Days

Incremental Construction Periods:

2002 Construction Increment: 2002 Work Days / Total Work Days = 137/200 = 0.685
2002 Value = Project Cost x 2002 Increment = $300,000 x 0.685 = $205,500
2003 Construction Increment: 2003 Work Days / Total Work Days = 63/200 = 0.315
2003 Value = Project Cost x 2003 Increment = $300,000 x 0.315 = $94,500

Midpoint of Construction:

2002 Midpoint: 2002 Work Days / 2 = 137 / 2 = 68.5 Project Days
2003 Midpoint: 2002 Work Days + Winter Shutdown + 2003 Work Days/2 =
138 + 180 + 63/2 = 349.5 Days
Weighted Midpoint = [(2002 Value x 2003 Midpoint) + (2003 Value x 2002 Midpoint)] / Project Cost
= [(205,500 x 68.5) + (94,500 x 349.5)] / 300,000 = 157 Days

Midpoint of Construction = 157 Project Days = December 4, 2002

Example 2: Analyzing Construction Items

(Same project schedule as used for Example 1):
(Note: Example and must be modified using the correct dates.)

|← Start Work → | |← Completed by →|

Item	Date	Calender Day	Project Day	Date	Calender Day	Project Day	Midpoint	Cost
Clr&Grub	7/01/2002	182	1	10/01/2002	274	93	46	$75,000
Exc &CMPs	8/01/2002	213	32	6/15/2003	166	350		$125,000
Season 1	8/01/2002	213	32	11/16/2002	320	139	85.5	$96,900
Season 2	5/15/2003	135	319	6/15/2003	166	350	334.5	$28,100
Aggr&Surf	5/15/2003	135	319	7/01/2003	182	366	342.5	$90,000
Seed&Mulch	7/01/2003	182	366	7/16/2003	197	381	373.5	$10,000

Clearing Midpoint: Clearing Work Days / 2 =(93-1) /2 = 46 Project Days

Excavation & Culverts Midpoint: This item falls during portions of two seasons. There are 107 construction days available in 2002 and 31 days available in 2003 for a total of 138 days.

Value of Work in 2002	107 days / 138 days x $125,000	= $96,900
Value of Work in 2003	31 days / 138 days x $125,000	= $28,100
Midpoint 2002	32 + (139 - 32) / 2	= Proj Day 85.5
Midpoint 2003	319 + (350 - 319) / 2	= Proj Day 334.5

Excavation & Culvert Weighted Midpoint = [(96,900 x 85.5) + (28,100 x 334.5)] / 125,000 = 141 Days

Aggregate Surfacing Midpoint = Item starting day + item days/2 = 319 + (366 - 319)/2 = 342.5 Days

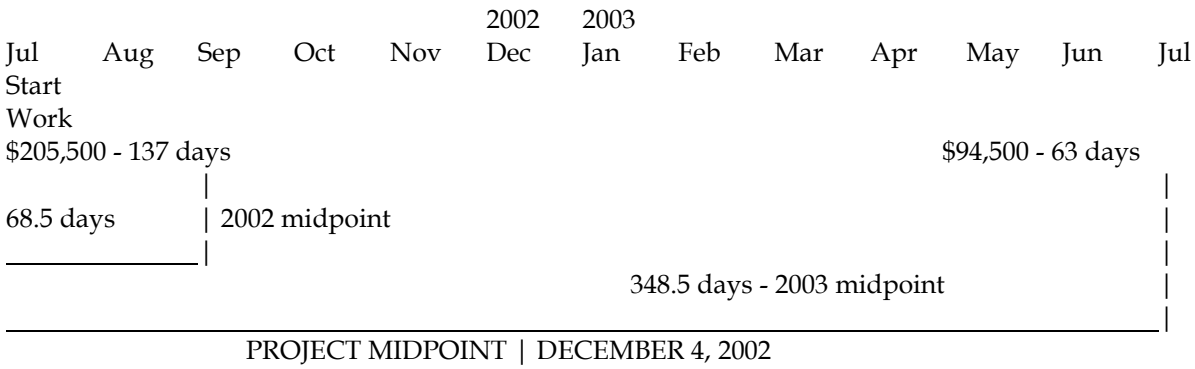
Seed & Mulch Midpoint = Item starting day + item days/2 = 366 + (381 - 366) / 2) = 373.5 Days

Weighted Midpoint = [(46 x 75,000) + (85.5 x 96,900) + (334.5 x 28,100) + (342.5 x 90,000) + (373.5 x 10000)] / 300,000 = 186 Days

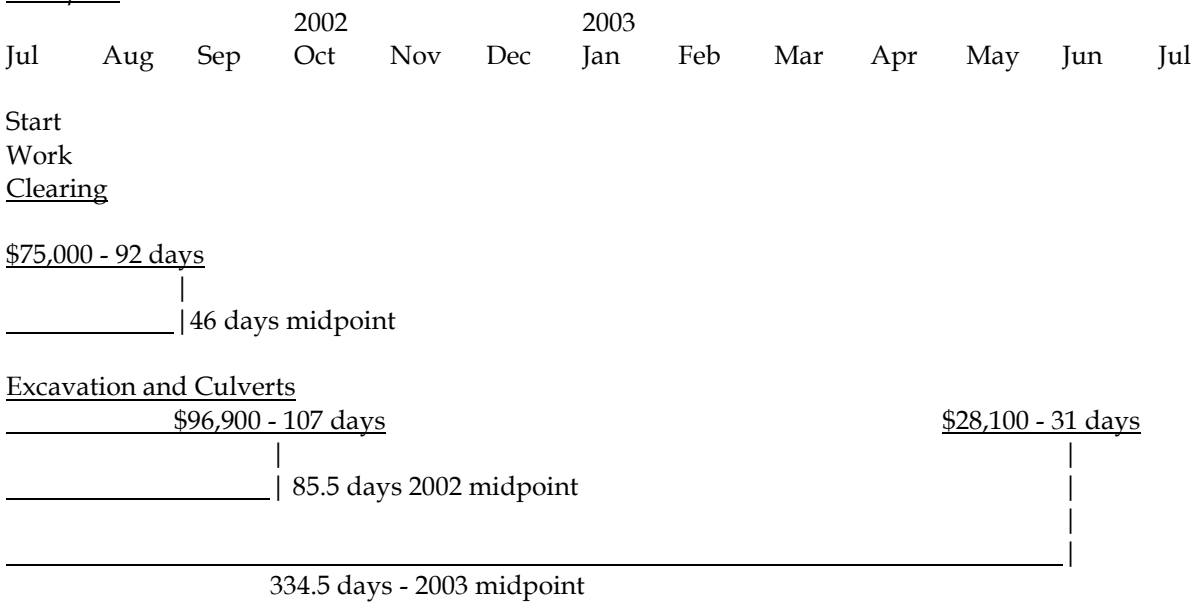
Midpoint of Construction = 186 Project Days or January 2, 2003

Note: This is an example, modify using the correct dates for your project.

Example Graphical Display of Midpoint Calculations



Example 2



Worksheet for Incremental Construction Periods

		DATE	DAY NUMBER
START WORK SEASON 1		_____	[A]_____
STOP WORK SEASON 1		_____	[B]_____
TOTAL DAYS SEASON 1	= [B] - [A]	= [C]_____DAYS	
START WORK SEASON 2		= _____	[D]_____
STOP WORK SEASON 2		= _____	[E]_____
TOTAL DAYS SEASON 2	= [E] - [D]	= [F]_____DAYS	
TOTAL CONTRACT DAYS	= [C] + [F]	= [G]_____DAYS	
TOTAL DAYS [A] TO [D]	= (365 - [A]) + [D]	= [H]_____DAYS	
VALUE OF WORK IN SEASON 1	= [C] / [G]	= [J]_____	
MIDPOINT OF SEASON 1	= [C] / 2	= [K]_____DAYS	
VALUE OF WORK IN SEASON 2	= 1 - [J]	= [L]_____	
MIDPOINT OF SEASON 2	= [H] + [F] / 2	= [M]____DAYS	
WEIGHTED VALUE MIDPOINT	= [J] X [K] + [L] X [M]	= [N]____DAYS	
MIDPOINT OF CONSTRUCTION	= ([A] + [N]) - 365	= [P]_____	
MIDPOINT	= JAN. 1 +[P] = _____		

Time Estimating and Scheduling Worksheet

Road completion date will be set by determining the timber sale advertisement and adding:

	Timber Sale (T.S.) Advertisement Date	_____
1.	Sale Advertising Period	30 Days
	Timber Sale Bid Opening Date	_____
2.	Period specified in the T.S. advertisement to allow the F.S. to solicit and award a P.W. Contract for the road construction. (120 days maximum without approval of additional time of Regional Forester prior to T.S. Advertisement date.)	80 Days*
	Public Works Construction Award Date	_____
3.	Additional time needed between P.W. contract award date and date construction could start.	10 Days
	Public Works Construction Start Date	_____
4.	Total calendar days elapsed time allowed for completion of road construction Public Works contract.	Days
	Computed Construction Completion Date	_____
5.	Additional time for expected excusable delays for P.W. contracts. This time will only be added to determine the road completion date in a Timber Sale (C5.101) not to determine contract time for a Public Works contract.	Days
	Final Completion Date	_____
	Planned Timber Sale Termination Date	_____

* The following time requirements may vary by local policy, 120 days is the maximum time allowed without approval of the Regional Forester.

10 days to submit road package to Administrative Services.
10 days to prepare road contract and send notice to Fedbizopps.gov
15 days to public prior to solicitation.
30 days advertising period.
15 days to award contract after bid opening; consider additional time if access to project is not available due to inclement weather.

80 days Total

End of Time Estimates and Calculation of Midpoint Construction

DIVISION 150 PROJECT REQUIREMENTS

Section 151. - MOBILIZATION

(Labor 20-40 percent)

Mobilization costs are those for preparatory work and operation including bonding and tasks necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for all other work and operations which must be performed or costs incurred including obtaining permits such as EPA storm water permits prior to beginning work at the project site.

The average project in the data base from which the information for this section was derived has two construction seasons; however, many are built in one season.

Use 7.0 percent for *contracts between $100,000 and $500,000* in Idaho and Montana and round to *two or three significant figures* (i.e. if calculation is $8,234.56, round off to $8,200 or $8,250). Additional allowances for moving in and out of specialized equipment (rock crusher, paving equipment, etc.), should be made under this pay item up to the point that it equals 10% of the total Engineer's Estimate. See Example 2 for details.

For *contracts under $100,000*, and for more complex projects (aggregate, paving, etc.) the actual costs should be estimated based upon moving normal components of machinery, personnel, etc., to/from the project, and the number of seasons for the operation. For actual costs use $3.00 a loaded mile per load. *Round off* calculated cost to two or three significant figures (see note above).

For *projects over $500,000* in Idaho and Montana, use 6.0 percent with additional allowances for specialized equipment if applicable. *Round off* calculated cost to two or three significant figures (see note above).

Example 1: Location - Montana Zone 1

Total of all pay items *without* Section 151	=$145,000
Cost(151)$145,000 x 0.07 =	= $ 10,150
Total Engineer's Estimate $145,000 + 10,150	= $155,150

Example 2 :Location, Idaho (Area 1, Zone 2)

Total of all pay items without Section 151	= $110,000
Rock Crusher required:	
Cost (151) $110,000 x .07	= 7,700
Crusher Movein/Moveout (Section 301)	= 9,000
Total Cost Allowance Section 151	= $ 16,700
Total Engineer's Estimate $110,000 + 16,700	= $126,700

Mobilization should not exceed 10% of $126,700, or $12,700 (rounded), so place $12,700 under Section 151 and $4,000 under Section 301.

Section 152. - CONSTRUCTION SURVEY AND STAKING

(Contract Item)

The estimator is reminded of the Regional policy, per FSM 7720 supplements, that engineers/surveyors involved in P-line surveys and design of Forest development roads or those under permit be licensed to practice in the State where the project is located. Also, on timber sales with purchaser survey and/or design requirements, the estimator should check C provisions for survey dates, type, etc.

Road Location: The most recent costs for road location range from $1,200-$2,400/mile.

Preliminary Survey: Costs for negotiated A/E contracts range from $850/mile for surveys of low-standard new roads (raw land) in open, easily accessible terrain, to $3500/mile for surveys of existing roads proposed for high-standard reconstruction. P-Line costs are generally dependent on survey standards, project access (drive, walk, camp, etc), terrain, vegetation density and time schedule. Establishment of spike camps can add costs to a project, long walks or difficult vehicle access can also increase the survey costs.

Recently, the average cost of all P-Line A/E surveys (new and reconstruction) is about $2,500-$4,000/mile. Detailed surveys of existing roads generally run higher than new construction due to the presence of cut/fill slopes, culverts, and other features. **If data entry of survey notes and plotting of profile, traverse, and X-sections are desired, add $500/mile.** Reestablishment of old P-Line can be estimated to cost about $400/mile.

Most contracts had some Medium Accuracy Standard survey, but were predominately Low Accuracy Standard survey. (Refer to FSH 7709.56, pg 3.9--2 for standards.)

Survey costs for A/E negotiated survey and design contracts should be estimated using the above costs for P-Line surveys as a base. Additional fieldwork may include items such as material and clearing classification, special site investigation, and stream flow estimates. The engineering firm will normally have a higher overhead cost because a business engaged in survey and design work usually has more office equipment, computers, etc. than a firm specializing in only survey work.

Information received from A/E contractors indicates the following average rates charged for fieldwork under negotiated contracts:

Wages and Per Diem

Fieldwork	Per Hour	Per day
Two-person field party	$125	$1000
Three-person field party	$165	$1320
Registered Land Surveyor	$90	$720

Per diem	Use current federal per diem rate
Transportation	$.50/mile
Motel, camp expenses	Use current federal CONUS rates

The following production rates should be used as a guide in estimating fieldwork:

Brushing: Three-person crew. The production for brushing is dependent upon density of stems and will vary with the requirements of the contract:

Density of stems	Miles per day
Extra heavy	0.35
Heavy	0.5
Medium	0.7
Light	1.0
Extra light	1.5

Traverse: three-person crew. The production for traverse is dependent upon the precision of survey and number of points of intersection (PI's) per mile. This cost estimate is broken down according to the precision desired. It is, therefore, mandatory for the estimator to know the precision required before making the estimate. The chaining difficulty is constant with the number of PI's per mile on which this cost guide will be based. For average conditions consider a production rate of a half mile per day of completed work.

Survey Accuracy Standard
(Refer to FSH 7709.56 Section 3.9)

PI's per mile	High Precision A or B Miles per Day	Medium Precision C or D Miles per Day	Low Precision E or Other Miles per Day
60 to 70	-	0.5	0.6
50 to 60	-	0.6	0.7
40 to 50	0.3	0.7	0.8
30 to 40	0.5	0.8	0.9
20 to 30	0.6	0.9	1.0
10 to 20	0.9	1.0	1.1
5 to 10	1.0	-	-

Levels: two-person crew. The production for levels is mainly dependent upon the precision of survey. Therefore, this cost guide is based on average production figures for a given precision. The estimator should use his/her own judgment and adjust these figures if they do not fit the individual project.

Accuracy Standard	Miles per day
High (A,B)	0.5
Medium (C,D)	0.7
Low (E, Other)	1.0

Cross Sections: Three-person crew. Cross sections are generally constant in production between 0.4 mile to 0.7 mile per day. The brushing for extra heavy and heavy brush are figured in the brushing estimate. Therefore, this item will consider the slope only. If the estimator has unusual circumstances, he/she should adjust the production figures accordingly.

Slope	Miles per day
50 percent +	0.4
30 to 50 percent	0.6
0 to 30 percent	0.7

Supervision: Allow 1 day per week of survey crew time for supervisory engineer @ $650 per day.

Move-in/Move-out: Allow for move-in/move-out costs, supplies, transportation, etc.

Office Work: Checking Notes-office work. All notes need to be office checked for completeness. Traverse and level notes need office work in recording and computation for angles and elevation. There is no per diem allowance for this work. Allow 1 to 2 hours per mile for one person at a rate of $108 per hour.

Materials Investigation and Testing: See Section 153 or 154 for unit costs.

Road Design: (Includes classification, plan & profile, cross sections, and plan-in-hand reviews) Ranges from $2,500 to 4,000 per mile for new construction.

Corner Search, Monumenting, and Boundary Marking & Posting: Corner search costs are highly variable, depending on terrain, access, and difficulty of finding evidence. Monumentation costs can be estimated at $150 to $175 per corner. Marking and posting boundary lines can be estimated at $5,000 to $7,500 per mile. Additional allowance should be made for areas in rugged terrain, poor access, and heavy ground cover.

Other Preliminary Surveys: Surveys with the total station equipment such as bridge sites or campgrounds, estimate using a two or three person survey crew. In addition, allow for travel expenses (mileage, camp, motel, etc) and the downloading and plotting of survey data at the office.

Construction Staking and Survey Staking:

Average base cost ($/mile)	
Transet L-line:	$1,600
Offset L-line-high order:	$1,400
Offset L-line-low order:	$1,300
Finish grade:	$2,000

Add $100.00 per culvert for culvert staking on reconstruction roads. Average base prices should be multiplied by the following factors to determine cost estimate. (Average project -- assume camp is within five miles of project and access is at the beginning of each job and each job is two miles in length.)

Approximate Relationships of Precision Options

Multiply by	High A	High B	Medium C	Medium D	Low E	Low Other
Establishing Centerline	1.2	1.1	1.0	-	-	-
Slope Staking	1.2	1.2	1.15	-	-	-
Finish Staking, Subgrade	1.1	1.05	1.0	-	-	-
Finish Staking, Base Course	1.2	1.2	1.1	-	-	-
Staking Major Structure(s)	1.0	1.0	1.0	-	-	-
Construction Staking	-	-	1.1	1.0	0.85	
Establishing Clearing Limits	-	-	-	-	-	0.3
Establishing Slope Stakes	-	-	1.0	-	0.6-0.8	-
Construction Survey & Staking	-	-	-	-	-	0.4
Finish Staking	1.1	1.05	1.0	-	-	-

Additional factors to consider:

Method I	Computed – multiply by 1.5
Method II	Slope staking one side - 1.0
	Slope staking both sides – multiply by 1.15 to 1.3
Side slopes	0-30% - multiply by 0.9
	50% and over – multiply by 1.1
Brush density	Light – multiply by 0.9
	Heavy brush – multiply by 1.2

Section 153. - CONTRACTOR QUALITY CONTROL

These costs are to be included as subsidiary to the respective pay items.

DO NOT HAVE QUALITY CONTROL AS A SEPARATE PAY ITEM!

Section 154. - CONTRACTOR SAMPLING AND TESTING

(Contract Item)

There are four aspects of contractor sampling and testing:

- Certificates of compliance
- Field and laboratory sampling and testing
- Field measurements
- Records of sampling, testing, and measuring

Projects that include controlled compaction for excavation, graded aggregate (not pit run), concrete, asphalt, major drainage structures, and similar work requiring specific sampling and testing (Included in FSSS 153 or FSSS 154).

- Approximately $30/day while the above-noted work is in progress.

- Approximately $20/day while the above-noted work is not in progress but work requiring contractor quantity measurements is in progress.

Projects that basically consist of clearing, excavation (Placement Methods 1 & 2), and minor culvert installation.

- Approximately $20/day while work requiring contractor quantity measurements is in progress.

The following table, **PROJECT FIELD SAMPLING AND TESTING,** gives estimated costs for contractor sampling and testing.

Overall costs for contractor sampling and testing, not including costs for individual tests, should range from $500/week for relatively simple projects to $2,000/week for more complex projects if only one technician is required. Add up to $1,000/week for each additional technician required.

The cost of a mobile lab may be required for more complex projects.

When more than one road project is included in a contract, the costs for Section 153 should be prorated among the individual roads or road segments based on project size and the type of work included in each individual road project.

For those contracts or projects having a small amount of contractor quality control per the FSSS's (no specific field tests), all costs are incidental to other items and should not exceed $50-$100/week. This cost is primarily associated with any contractor measurement that is required. For simplicity, it may be advisable to add this cost to Mobilization rather than spread it over several items.

PROJECT FIELD SAMPLING AND TESTING

Description	Estimated Cost
Asst. Project Engineer	$130/hour (Assume 1 visit per month or $260/week)
Sr. Eng. Technician	$65/hour (Assume 2 visits per month or $260/week for complex projects 1 visit per month or $120/week for standard projects)
Eng. Technician	$60/hour (Required daily for extensive sampling and testing, $480/day or $2400/week for other projects, 3 days/week or $1440/week)
Mileage	$0.50/mile
Per diem	Approximately $80/day
Vehicle	$100/wk. + $0.50/mile
Mobile lab	$500/wk.+ mobilization
Tests (in laboratory)	
Mechanical analysis	$105
Sieve analysis	$80
Atterberg limits	$80
Moisture/density	$150
R-Value/CBR	$500
Tests (in field)	
Inplace density	$75 for first test and $35 for each additional
Sieve analysis	$105
Moisture/density	$130
Concrete	
Mix design	$1500
Compression test	$30
Field test (including air, slump, cast and test 3 cylinders)	$175
Asphalt	
Mix design	$2250
Extraction	$200
Gradation	$280
Field Density/Coring	$185/hr
Bulk Specific Gravity of core	$60 each

Section 156. - PUBLIC TRAFFIC

The cost of opening a road under reconstruction to traffic several times during the day can add as much as 50 percent to the normal cost of excavation, culverts, clearing, etc. This is due to the decrease in work efficiency and production on the part of the contractor and increased liabilities for public safety. Traffic volumes normally found on most Forest Service roads generally do not justify opening the road more than once during the work shift, and only if the road has significant traffic. If difficult construction work such as rock blasting or large culvert replacement is anticipated on existing roads, total road closure should be considered in the interest of public safety and cost savings. All too often road openings are for the convenience of the Forest Service and have little bearing on public use, particularly during weekdays.

Construction Induced Maintenance (CIM). Payment for construction induced maintenance can be made in several ways, depending on the situation. CIM shall be included in and made a requirement of the contract, public works or timber sale.

- When CIM is required to support a specific construction activity, payment and the cost estimate should be subsidiary to that item. Hauling of aggregate or borrow are examples of this. Maintenance associated with transport of right-of-way timber will be included in construction cost only for capital investment projects and only when timber becomes property of the contractor.

- If the CIM is required to support general construction access and traffic, CIM can be a subsidiary item to mobilization.

- If the amount of CIM is uncertain or likely to be variable, it may be advisable to estimate and make payment based on actual quantities under Section 622, Rental Equipment.

In all cases, appropriate Forest Service Supplemental Specifications to Section 156 are required to define the work and indicate how payment will be included in the contract. Due to the possibility of 14i turnbacks, C5.312 shall not be used to cover CIM under timber sales. Be sure to follow directions regarding commensurate shares when estimating and specifying this work.

Section 157. - SOIL EROSION CONTROL

This work consists of temporary and permanent measures incorporated into the project to reduce and control soil erosion and water pollution. The estimator should consider all measures used to provide this protection. Measures taken may be in areas that in the past have been considered "normal practice", i.e., waterbars constructed on roads during construction, or they may be items that have been designed specifically for erosion control. Timing may impact costs, i.e., if rock blankets are required prior to constructing a road to pit run borrow source, an alternate source which may be more costly is necessary.

Costs may be estimated directly under Section 157 and shown on the Schedule of Items or may be incidental to other pay items. Some examples of cost item determination are:

Section 157.09 Diversions, Earth Berms. The purpose of the berm is for a reduction of erosion. Payment for this item may be subsidiary to other items or paid for under Section 157

Section 157.05Filter Barriers,Silt Fence. This is a specialized pay item and would not fall under other items of work. It should be used in the contract specifically as a soil erosion item, under Section 157.

Section 157.11 Temporary Turf Establishment. This work is accomplished solely for the purpose of erosion control. The cost of this work is directly related to Section 157. This cost should not be considered under Section 625.

If the primary purpose of the windrow is slash disposal, this work should be priced under Section 201. When all or part of this cost is exclusively for erosion control, it should be shown as a cost under Section 157.

For items not listed here or covered under other items, estimate by time, material and equipment. After calculating cost, determine labor percentage and make appropriate reductions for timber sales.

Cost of preparing storm water permit applications or turbidity permits for EPA or State agencies should be included in Section 151.

Some items associated with Soil Erosion and Water Pollution Control are:

Suggest Parent Specification	Description of Work	Pay Unit	Estimated Cost	Percent Labor
157	Temp Seeding & Fertilizing Seed @ 40 lb/acre, seed & fertilizer in one application Fertilizer @ 200 lb/acre Material Price/Acre = $180-$340	Acre	$300-$600	20-70%
157	Dry Mulching (Straw or Hay) Seed @ 40 lb/acre Fertilizer @ 200 lb/acre Straw or Hay @ 2 tons/acre	Acre	$600-$1000	20-70%
157	Hydromulching (Wood Cellulose) Seed @ 40 lb/acre Fertilizer @ 200 lb/acre J-TACK H-S @ 120-160 lb/acre Wood Cellulose Fiber @ 150-300 lb/acre Hay or Straw @ 2 tons/acre Water as Necessary	Acre	$3500-$5500	20-50%
157	Temporary Netting Should price using specific Material / Labor, etc Permanent Netting Should price using specific Material / Labor, etc Material Price/SY = $2- $5	S.Y.	$7-$9	40-90%
157	Straw/Hay Bales(Weed free required) Bales placed by hand below CMP's prior to installation at live water; also used below outlet of cross-drains in highly erosive soil areas and in ditches. Material Price/bale = $4-$7	Each	$15-$30	60-90%

Suggest Parent Specification	Description of Work	Pay Unit	Estimated Cost	Percent Labor
157	Gravel Blanket Sheathing	C.Y.	Estimate by Materials, Time & Equipment	
157	Silt Fence Used 8' long Steel Posts @ 6' centers with 47" Hog Wire, Geotextile Fabric. Material Price/LF = $3	L.F.	$4-$12	30-60%
157 or 201	Brush Barrier Method 12 In R-1 Cost Guide This work consists of placing brush on the fill slope to reduce sediment erosion.	L.F.	Estimate using Cost Guide, Section 201	
157 or 201	Sediment Basin Scoop native material from stream bed below live water prior to installation of new CMP. Placebrush and straw bales on down-stream end of sediment basin. Can also place bales w/ brush to impede sediment flow. Use Time & Equip, estimate 15-30 min. w/ Cat 225	Each	Estimate by Materials, Time & Equipment	
157 or 201	Berm Earth Berm	L.F.	$0.10-$0.15	30%
157 or 201	Dam	Each	Estimate by Materials, Time & Equipment	
157 or 201	Temporary Water Bars Constructed very shallow upgrade, but near CMPs and also midway between CMPs. Should be constructed just prior to compaction. Aggregate may be placed over temp waterbars, w/o removal. Temp waterbers will not provide adequate protection when installed with soil in overly saturated state. Not intended for permanent use. Equipment - Cat 140 w/ operator, rate of production is 15-25 bars/hr. Estimate construction just prior to compaction, no additional allowance made for compaction.	Each	Estimate by Materials, Time & Equipment	
204	Permanent Water Bars Constructed to design depth and location. Equipment - Cat D8K w/ operator rate of production is 3-4 bars/ hour	Each	Estimate by Materials, Time & Equipment	

Suggest Parent Specification	Description of Work	Pay Unit	Estimated Cost	Percent Labor
204	Construction Dips Equipment - D8K w/ operator and/or Grader Cat 140 w/ operator	Each	Estimate by Materials, Time & Equipment	

Section 160. - DEVELOP WATER SUPPLY AND WATERING

(Labor 40-70 percent)

Estimated Quantity

For embankment, 5-10 gal/CY
For base and surface courses, 35-44 gal/CY or 20-25 gal/ton.

Total Cost

Watering cost includes installing either a pump or gravity system to fill the tanker, filling time, and haul.

Estimating development of water source

If any other work is required such as digging a basin, constructing a large check dam or constructing a spur road, compute these costs by using time and equipment methods.

Haul Costs (Includes truck and driver time)

Calculate haul costs from the source to the center of project. Center of project is the center of embankment mass for excavation and linear center of project for base and surfacing.

The figures for ton-mile give the cost for 0.25 M-gallon.

Estimator is cautioned that designs including this section as a separate pay item require *additional inspection and control* by FS contract administration personnel during construction, coordinate with them when costing for this item.

End of Division 150 Project Requirements

DIVISION 200 EARTHWORK

Section 201. - CLEARING AND GRUBBING

(Labor 20-55 percent)

Section 202. - ADDITIONAL CLEARING AND GRUBBING

General: There are too many variables reflected in the bids to use them solely as a basis for costs. Therefore Figure 201-1 is given as a starting point for an "average" new construction project. The designer will need to consider the uniqueness of the project and estimate accordingly. Also consider the amount of vacant (no clearing) area in relation to the acreage being cleared. The factors used are based on the use of the hydraulic excavator for clearing/pioneering. **Clearing may need to be adjusted to meet total mechanical clearing.**

Clearing Classification: There are two methods of classification.

- Classification by volume per acre of timber within clearing limits
- Classification by Stand Description

Classification by volume per acre of timber within clearing limits

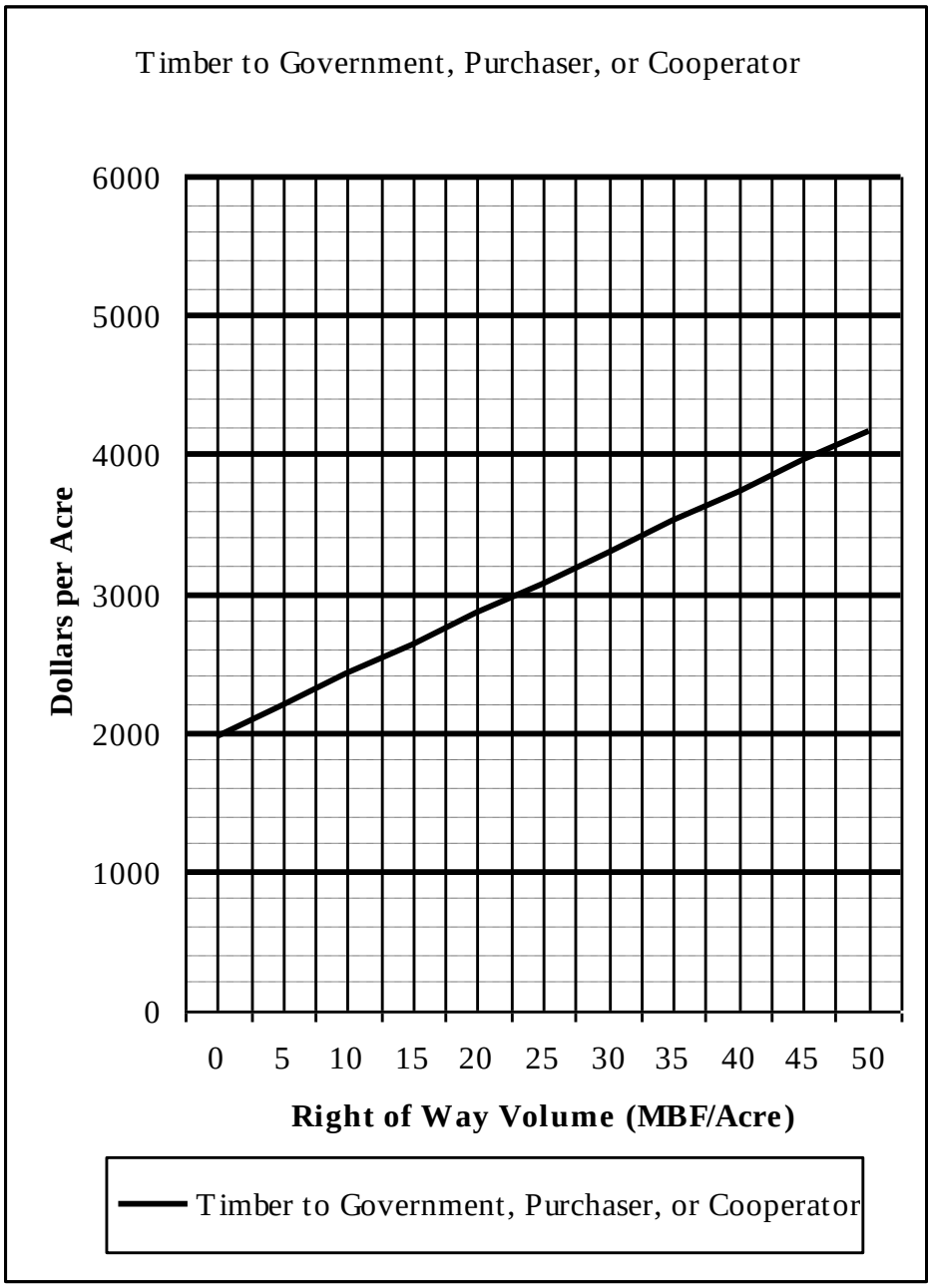
The classification of clearing by volume per acre is shown on Figure 201-1, this section. It is essential that timber volumes be estimated within accuracy standards. Estimators should request gross volume figures for estimating use.

Clearing cost estimates should compensate for down material as well as that which is standing. In some cases the down volume is insignificant while in others it may be more difficult to handle than standing volume. Therefore, an adjustment factor for down material of 0 to 1.2 is appropriate.

Example:

Gross volume from timber cruise: ..... 12 Mbf/Acre
Gross down volume: ..... 6 Mbf/Acre
Factor for down material: 0.5
Volume for classification: 12 + (6 x 0.5) = 15 Mbf/Acre

Figure 201-1 Clearing and Grubbing
(Costs Based on Windrowing)



Timber to Government, Purchaser, or Cooperator

	Right of Way Volume (MBF/Acre)										
	0	5	10	15	20	25	30	35	40	45	50
Dollars per Acre	1980	2200	2420	2640	2860	3080	3300	3520	3740	3960	4180

Classification by Stand Description

Clearing classification by stand description is based on a uniform mixture of large and small trees. The classification can be based on the stem spacing and average diameter as shown on Figure 201-2, this section, or by the guidelines below. Additional items to be considered are the amount and size of down material and the size of stumps and limbs.

- ***EXTRA LIGHT:*** Few tops and limbs. Few, if any, cull logs. Low scattered brush. Little or no falling or yarding of unmerchantable timber required.

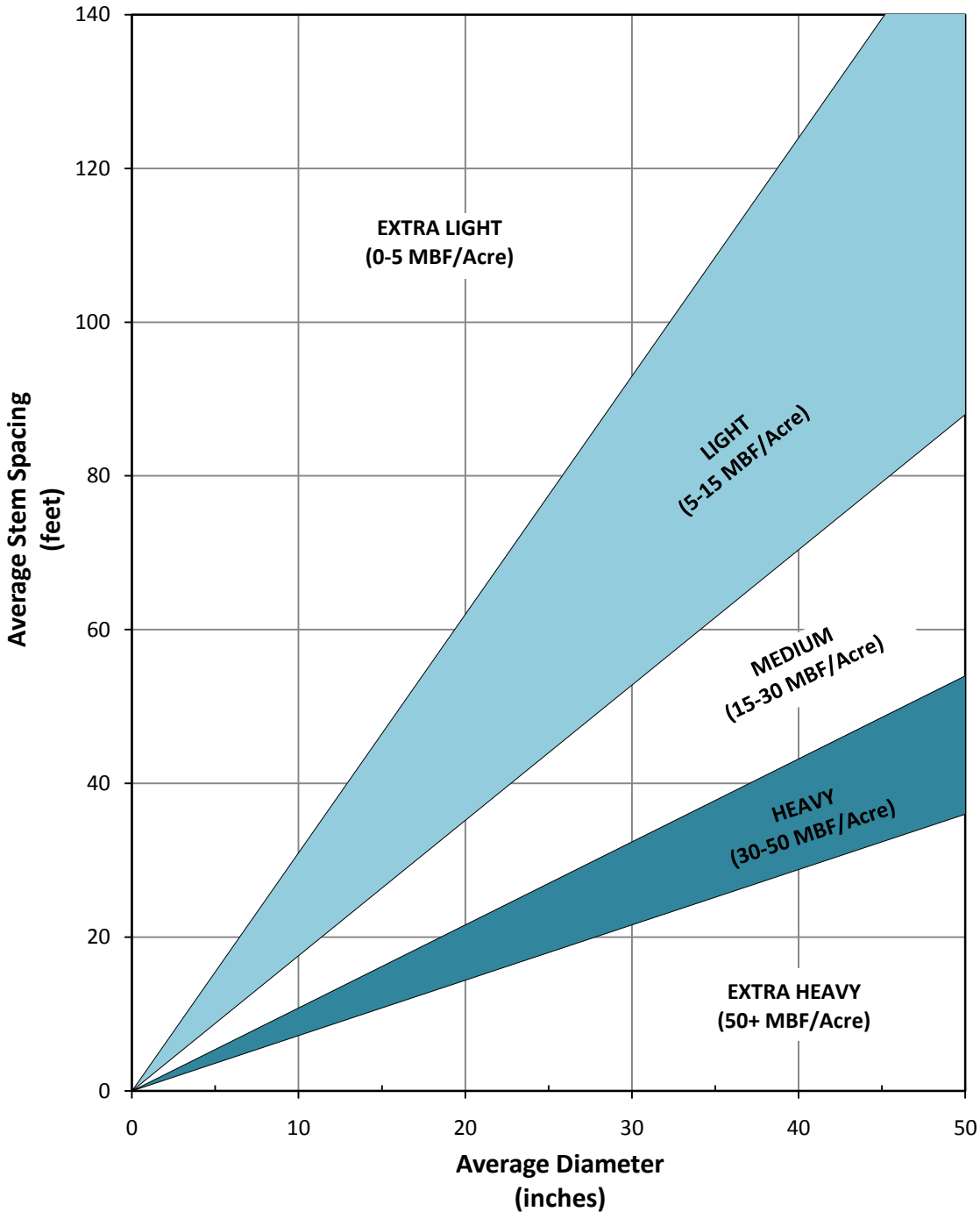
- ***LIGHT:*** Light to moderate amount of tops and limbs. Few cull logs. Light brush. Little to moderate falling or skidding of unmerchantable required.

- ***MEDIUM:*** Light to moderate amount of cull logs. Many tops and limbs. Tall brush or dense unmerchantable trees requiring falling. Some unmerchantable material requiring skidding.

- ***HEAVY:*** Many tops and limbs from dense stand of unmerchantable timber. Tall, heavy brush or dense unmerchantable pole stand requiring falling and bucking numerous cull logs. Yarding of unmerchantable necessary.

- ***EXTRA HEAVY:*** Much cull material requiring falling. Many large, downed cull trees. Area may be swampy or wet. Closely spaced extra large stumps. Thick duff and other organic material.

FIGURE 201-2
Equivalent Volume using Average Diameters and Stem Spacing



Topographic Factor: The cost-per-acre figures should be adjusted by the following topographic factors:

Ground Slope	Factor
Gentle (under 20 percent)	1.1
Moderate (20 to 45 percent)	1.0
Steep (over 45 percent)	1.1-1.3
Areas that require more than one pioneer or a long boom machine due to high cut/fill	1.4-2.0

Slash/Cleanup Factor: Clearing estimates must be based on the lowest cost treatment option allowable to the contractor. The cost-per-acre figures must also be adjusted by the slash cleanup factor if the required treatment method is other than windrowing. Care must be exercised in applying this factor, however. For example, "scattering" in steep terrain or in areas of dense undergrowth can result in significantly higher costs than windrowing. The adjustment factor 1.15 for scattering would apply for average side slopes and open understory. If stumps are to be split or partially buried, the factor used for them may need to be adjusted.

Treatment Method	Factor
Windrow	1.0 - 1.1
Windrow and Cover	1.25
Scattering	1.15 - 1.35
Burying	1.6 – 2.0
Chipping	1.75
Pile and Burn	1.6 - 2.0
Deck Unmerchantable Material	1.1
Disposal in Cutting Units	1.2
Removal	2.0
Piling	1.3
Placing slash on embankment slopes	1.4

Different treatment methods may be specified for Tops and Limbs, Logs, and Stumps. When this occurs, the following table should be used to prorate costs based on the treatment method specified for each type of slash. Adjustments can be made to meet local project conditions.

COST PERCENTAGE FOR SLASH TREATMENT

Multiply Slash Treatment Factor by	Tops & Limbs	Logs	Stumps
	40%	35%	25%
If Pile and Burn is designated for Stumps:	30%	20%	50%

Example:

Given: Treatment Methods for: Tops and Limbs - Pile and Burn
Logs - Windrow
Stumps – Scatter

$$\text{Adjusted Slash Treatment Factor} = \underset{\text{Tops \& Limbs}}{(0.40)(1.6)} + \underset{\text{Logs}}{(0.35)(1.00)} + \underset{\text{Stumps}}{(0.25)(1.15)} = 1.28$$

Other Factors: Additional areas and/or strips may need to be cleared, but not grubbed, for burning bays, decking areas, and for windrowing right-of-way slash in dense lodgepole pine stands. The cost allowances for these situations should consider the treatment of tops and limbs, and logs, but not stumps. The factors for each of these is shown above. Clearing costs associated with campgrounds will normally be higher.

Cost allowance for *painting and branding* of logs, where required, is considered incidental to the clearing cost estimate, no separate allowance is generally required.

Individual Removal of Trees

(Labor 80 percent)

This includes falling and treating hazard trees that lie outside of the clearing limits. Average cost: $30 per tree.

Brushing

(Labor 50-90)

General: The designer will need to consider the uniqueness of the project and estimate accordingly. Consider the area being cleared and the type of equipment that can operate safely. Consider the spacing as well as the diameter of the trees and brush to be cleared when classifying the material. The topographic factors and the ground cover should be considered when selecting the type of equipment and slash treatment method to be used. If equipment can not operate safely use the hand labor factor.

Clearing Classification By Stand Description: Clearing classification by stand description is based on an average mixture of size, spacing, and density of the trees and brush.

Light ($400-$750/mile)
Few trees and low brush scattered along the shoulders of the roadway. Production rate approximately 1000 ft per hour.

Medium ($750-$1500/mile)
Trees and brush along the entire length of the shoulders of the roadway. Production rate approximately 750 ft per hour.

Heavy ($1500-$3000/mile)
Trees and brush scattered throughout the entire roadway. This cost range considers the grubbing of the roadbed. Production rate approximately 400 ft per hour.

Extra Heavy ($3000-$4000/mile)
Trees and brush densely spaced along the entire roadway. This cost range considers the grubbing of the roadbed. Production rate approximately 200 ft per hour.

Topographic Factor: assume work is being accomplished along and existing roadbed with cuts and fills needing special attention. The unit cost should be adjusted by the following factors:

Ground Slope	Factor
Gentle (under 20 percent)	1.0
Moderate (20 to 40 percent)	1.1
Steep (over 45 percent)	1.3

Labor Factor: Labor factor of 1.25 should be applied to projects that do not use a machine to do at least part of the brushing operation.

Slash Cleanup Factor: The unit cost should be adjusted by the following factors

Treatment Method	Factor
Scattering	1.35
Burying	1.50
Piling and Burning	1.50
Piling	1.30
Placing slash on embankment slopes	1.35

Section 203. - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

(Labor 30-50 percent)

Removal of Existing Bridges: This item should be estimated on an individual basis. Cost of equipment, labor, disposal, move-in and move-out of any special equipment, etc., needs to be considered. Use the equipment and labor costs in computing the cost (see Equipment Rates and Labor Rates).

Removal and Stockpiling/Disposing of Cattleguards: This item must be estimated on an individual basis. Cost of equipment, labor, disposal, move-in and move-out of any special equipment, etc., needs to be considered. Use the equipment and labor costs in computing the cost (see Equipment Rates and Labor Rates).

Removal and Disposal of Pipe Culverts: This should be estimated using time and equipment. Consideration should be given to the salvage value and disposal method of the culvert. Also consider if the culvert is being replaced at the same location.

Note: In addition to the above costs for removal of bridges, pipes, etc.; additional allowances may be necessary for removal of approach fills, reclamation and rehabilitation work, and for disposal of hazardous and toxic materials such as creosoted beams.

Section 204. - EXCAVATION AND EMBANKMENT

(Labor 20-45 percent)

Localized conditions (slope, classification, etc.) have more impact on costs for small jobs because a full range of conditions may not exist as in a larger job.

Excavation for constructing catch basins on reconstruction projects which add drainage should have the same unit cost as the culvert excavation. Both jobs will be done using the same equipment; therefore, costs should be similar. Separate pay items should be used, one for construction of catch basins and one for culvert installation.

Base Cost

The average **BASE COST** of common excavation in ID or MT is **$1.80/cy**.

Material adjustment factors:

Material Type	Factor
Common	1.0
Loose rock	1.5-1.75
Talus rock	1.5
Small glacial Boulders	1.75
Rippable rock	3.0
Large glacial boulders	5.0
Solid/Shot rock	5.0-8.0

Base costs are to be **adjusted by adding** the following if required.

- **Tolerance Class:** See Finishing.
- **Compaction Method:** (Does not include water, make an allowance or estimate under Section 160)

Compaction Method	ID or MT $/cy
Method A – More than 80% retained on a No.4 Sieve	$1.02
Method B – 50% to 80% retained on a No.4 Sieve	$1.16
Method C – Less than 50% retained on a No. 4 Sieve	$1.30
Method D – Layer Placement (Hauling and Spreading Equipment)	$0.56
Method E – Layer Placement (Roller Compaction)	$0.90

Note: If applicable, make a subsidiary allowance to this pay item for contractor quality control for Compaction Methods (b) and (c).

- **Benching Fill Slopes:**

  30-45 percent slope: $0.98/LF
  45-60 percent slope: $1.54/LF

Note: If hydraulic excavators are used, there will be no additional cost for benching fill slopes as work will be done during clearing/pioneering.

- **Finishing:**

Scarifying:

Add	$/Station (Single Lane) ID or MT
Light	$12.35
Average	$16.47
Heavy	$25.78

Shaping and Finishing:

Single Lane Roads *with Ditch* -- $/Station

Tolerance Class	A	B/C	D/E	F/G/H	I/J/K/L/M
Rate (days/mi)	3.5	2.25	1.0	0.75	0.5
Cost*					
ID	$71.14	$45.53	$20.63	$14.94	$9.96
MT	$86.51	$55.50	$24.49	$18.78	$12.32

* For Double Lane, multiply single lane cost by 1.35

Single Lane Roads *without Ditch* -- $/Station

Tolerance Class	A	B/C	D/E	F/G/H	I/J/K/L/M
Rate (days/mi)	2.0	1.25	0.75	0.5	0.25
Cost*					
ID	$39.76	$25.61	$14.94	$9.96	$4.98
MT	$49.79	$37.54	$18.78	$12.25	$6.53

* For Double Lane, multiply single lane cost by 1.35.

- **Loading Material into Trucks:**

Material Type	ID or MT $/cy
Common and loose rock	$0.98
Ripped rock	$1.41
Blasted rock and large boulders	$1.68

- **Conservation of Rock:**
  For use when excavating with a dozer or excavator and placing in small stockpile within 300 ft. When excavating and hauling to central stockpile or use point, the added cost of excavation should be covered above under Loading Material into Trucks.

- **Haul:**
  Haul should be included under this item at the rate of $0.16/Sta. Yd. for both Idaho and Montana

- **Conservation of Topsoil:**

Stripping topsoil and windrowing with grader, relatively flat ground:	$12.20 /sta
Stripping topsoil with tracked loader and placing in stockpile within 300 ft. (91m):	$23.11 /sta

- **Traffic Control:**

Open to traffic twice during work shift	30 percent of Base excavation cost plus options
Open to traffic once during work shift	15 percent of Base excavation cost plus options
Open to traffic at end of work shift	5 percent of Base excavation cost plus options

- **Slope Blending:**
  Depending on material and type of slope blending specified, additional costs of $.05 to $.15/LF are applicable. This assumes the work being done at start of excavation immediately following pioneering. Slope rounding is a more deliberate practice; estimates are made under Section 204

- **Compaction Prior to Base and Surfacing Work (if required):**

Singe Lane	Double Lane
$5.81/sta	$7.75 /sta

- **Water:** estimate under Section 160, or include an allowance under this item.
- **Pit Development:** estimate under Section 641.
- **Quality Control:** estimate based on sampling and testing noted under Section 153 and as specified in FSSS 153 for project.

Rounding Cut Slopes
This work, if specified, applies to sophisticated "rounding" after initial pioneering and excavation, and not to blending of the cutslope with the natural ground during initial excavation which is can be done by a hydraulic excavator. Estimate by time and equipment, costs range from $0.50 to $0.75/LF.

Drainage Excavation and Furrow Ditches
Drainage excavation can be estimated most easily by the lineal foot. The same piece of equipment is required for small quantities or larger amounts; but one may use something less efficient for very small amounts. Site conditions govern more than size considerations; estimate by time and equipment procedures.

Drainage Dips
Drainage dips on reconstruction can be estimated at $125 to $200 each depending on material and distance between dips.

Earth Berms
Continuous Berms cost about $15 per station or $.15/LF

Example Earthwork Calculation

Given: Single lane, aggregate surfaced road with ditch, Compaction Method (e), Tolerance Class G, 30% labor

Excavation: 80,000 cy 70 percent common
15 percent rippable rock
15 percent blasting rock

Benching: 30-45 % slope - 1500 LF
45-60% - 2500 LF

Finishing: Scarification: Light - 115 sta
Average - 72 sta
Heavy - 15 sta

Shaping and Finishing: 262 sta

Compaction: prior to aggregate base 262 sta.

Traffic Control: N/A.

Location A.: Montana - Zone 3
Location B.: Idaho - Area 1 (Zone 2)

Solution - Location A. Montana Zone 3:

Base Excavation

	Quantity		*Quantity Adjustment*		*Base Excavation Cost*		*Material Adjustment Factor*		*Cost*
Common:	80,000	x	0.7	x	$1.80	x	1.00	=	$ 100,800.00
Rippable:	80,000	x	0.15	x	$1.80	x	3.00	=	$ 64,800.00
Blast:	80,000	x	0.15	x	$1.80	x	5.00	=	$ 108,000.00

Additions to Base Excavation		*Quantity*		*Cost*		
Benching Fill Slopes:	30-45 percent:	1,500	x	0.98	=	$ 1,470.00
	46-60 percent:	2500	x	1.54	=	$ 3,850.00
Compaction Method (e):		80,000	x	0.90	=	$ 72,000.00
Finishing: (Tolerance Class G)	Scarifying:					
	Light:	115	x	$12.35	=	$ 1,420.25
	Average:	72	x	$16.47	=	$ 1,185.84
	Heavy:	15	x	$25.78	=	$ 386.70
	Shaping and Finishing:	262	x	$18.78	=	$ 4,920.36
	Compaction prior to base:	262	x	$5.81	=	$ 1,522.22
				Total Engineers Estimate w/o Quality Control	=	$ 360,355.37
				Quality Control - 1% of Total Engineers Est.	=	$ 3,603.55
				Total Engineers Estimate including Quality Control	=	$ 363,958.92

Unit Cost Calculation

Unit Cost ($/cy) w/o Quality Control = $360,355.37 / 80,000 = $4.50

Unit Cost ($/cy) w/Quality Control = $363,958.92 / 80,000 = $4.55

Location - Zone Calculation

	Unit Cost ($/cy)		*Adjustment Factor for Davis Bacon Zones*		*Adjusted Unit Cost ($/cy)*
Zone 3 Unit Cost (Engineers Estimate w/o Quality Control)	$4.50	x	1.00	=	$4.50
Zone 3 Unit Cost (Engineers Estimate with Quality Control)	$4.55	x	1.00	=	$4.55

Location - Wage Differential Calculation

	Unit Cost ($/cy)		*Adjustment Factor for Wage Differentials*		*Adjusted Unit Cost ($/cy)*
Specified Road Construction Cost (without Quality Control)	$4.50	/	1.11	=	**$4.05**

Solution - Location B. Idaho Area 1 (Zone 2):

Base Excavation

	Quantity		*Quantity Adjustment*		*Base Excavation Cost*		*Material Adjustment Factor*		*Cost*
Common:	80,000	x	0.7	x	$1.80	x	1.00	=	$100,800.00
Rippable:	80,000	x	0.15	x	$1.80	x	3.00	=	$ 64,800.00
Blast:	80,000	x	0.15	x	$1.80	x	5.00	=	$108,000.00

Additions to Base Excavation		*Quantity*		*Cost*		
Benching Fill Slopes:	30-45 percent:	1,500	x	0.98	=	$ 1,470.00
	46-60 percent:	2500	x	1.54	=	$ 3,850.00
Compaction Method (e):		80,000	x	0.90	=	$ 72,000.00
Finishing: (Tolerance Class G)	Scarifying:					
	Light:	115	x	$12.35	=	$ 1,420.25
	Average:	72	x	$16.47	=	$ 1,185.84
	Heavy:	15	x	$25.78	=	$ 386.70
	Shaping and Finishing:	262	x	$14.94	=	$ 3914.28
	Compaction prior to base:	262	x	$5.81	=	$ 1,522.22
				Total Engineers Estimate w/o Quality Control	=	$ 359,349.29
				Quality Control - 1% of Total Engineers Est.	=	$ 3,593.49
				Total Engineers Estimate including Quality Control	=	$ 362,942.78

Unit Cost Calculation

Unit Cost ($/cy) w/o Quality Control = $359,349.29 / 80,000 = $4.49

Unit Cost ($/cy) w/Quality Control = $362,942.78 / 80,000 = $4.54

Location - Zone Calculation

	Unit Cost ($/cy)		*Adjustment Factor for Davis Bacon Zones*		*Adjusted Unit Cost ($/cy)*
Zone 3 Unit Cost (Engineers Estimate w/o Quality Control)	$4.49	x	1.00	=	$4.49
Zone 3 Unit Cost (Engineers Estimate with Quality Control)	$4.54	x	1.00	=	$4.54

Location - Wage Differential Calculation

	Unit Cost ($/cy)		*Adjustment Factor for Wage Differentials*		*Adjusted Unit Cost ($/cy)*
Specified Road Construction Cost (without Quality Control)	$4.49	/	1.08	=	**$4.16**

HAUL

(Labor: Cu Yd Mile, 35 percent; Sta Yd, 25 percent. Note: the haul of asphalt and aggregate may be a contract item. If so, do not reduce, if the subcontractor is expected to pay Davis-Bacon wages)

Note: Haul is not a pay item, costs are incidental to and included in other items of work)

Station yards is used when material is moved using dozer pushes; where as; cubic yard-mile is used when material is hauled by truck.

Cost for Haul, in Idaho and Montana is $0.14/sta-yd; and $.50 to $1.00/cubic yard-mile depending on haul distance, road conditions, etc.

Cost for cubic yard-mile haul of excavation, aggregate, riprap, borrow excavation, etc., should be derived with the use of the following procedure.

Haul of material includes the fixed costs (for the truck only) of spotting, load, and turnaround in addition to the variable "underway" cost while hauling equipment is moving. Loading costs for the loading labor and equipment should be included under the parent specification for that work.

Haul of excavated material is to be measured (for payment) in terms of excavated cubic yards in the original position (in place). Costs shown below are based on loose cubic yards; therefore, a compaction factor adjustment (CF) must be made to provide costs based on excavated cubic yards.

$$CF = \frac{\text{in place density}}{\text{loose density}}$$

To compute haul of aggregate, borrow, riprap, etc., the compaction factor, CF, must be adjusted to fit the method of measurement; i.e., in place, vehicle quantity, compacted in place, etc. The costs per ton shown below are based upon 1.4 tons per cubic yard. Note that haul of excavation, when authorized as a pay item, is usually calculated by the cubic-yard-mile. Haul of materials that are weighed in tons are calculated in ton-miles.

When computing variable haul cost, the estimator should consider all the factors that affect the haul over each segment of the haul route. These factors include grade, alignment, road width, type of surface, road condition, sight distance, turnout spacing, and other traffic using the road. Use the correct truck for the type of road on the haul route (belly dumps are inappropriate for crooked narrow roads).

Variable costs should be increased if load limits (bridges, city streets, etc) on the route preclude loading trucks to rated capacity. The average distance from the point of dumping to the turn-around should be included in the variable cost haul distance. On single-lane roads this may range up to 2-3 miles additional length, on two-lane roads no addition is usually necessary since the trucks can turnaround nearby. Also, if there are similar conditions at the material source which affect travel distance, make allowance.

The following are general guidelines the estimator should use in determining average round-trip travel speeds for haul computations.

Average Travel Speed	Road Characteristics
5-15 mph	Narrow dirt road, steep grades, numerous sharp curves, poor sight distances and few turnouts

Average Travel Speed	Road Characteristics
10-30 mph	Dirt or gravel surface, single lane, grades to 8%, fair to good alignment, adequate turnouts, and good sight distance
25-50 mph	Gravel or paved surface, double lane, moderate grades to 6%, good to excellent alignment, excellent sight distance

Fixed Cost: (Increase fixed costs to reflect difficult or unique situations in loading or dumping material, such as asphalt or riprap.)

12 CY End Dump	$0.76/CY	or $0.54/Ton
20 CY Bottom Dump	$0.92/CY	or $0.65/Ton

Variable Cost - $/CY-Mile or $/Ton-Mile:

mph	12 CY End Dump $/cy	12 CY End Dump $/Ton	20 CY Bottom Dump $/cy	20 CY Bottom Dump $/Ton
10	$2.46	$1.74	$1.98	$1.39
15	$1.64	$1.21	$1.31	$0.94
20	$1.24	$0.88	$0.98	$0.72
25	$0.98	$0.72	$0.77	$0.56
30	$0.82	$0.57	$0.65	$0.45
40	$0.62	$0.45	$0.47	$0.36
50	$0.48	$0.35	$0.40	$0.28

Example Format
The following is an example format to be used for computing variable cost.

QUANTITY_____LOOSE CUBIC YARDS

HAUL COST

Road Segment	Average Speed Roundtrip	Length Miles	$/CY-Mile or $/Ton-Mile	CY (or Tons)	Variable Cost
Enter mile post description for the road segment	Enter the average speed for road segment	Enter miles for road segment	Enter cost from Variable Cost table above	Enter the quantity for road segment	Multiply $/cy (ton) by quantity
			Total	(2)	(1)

The *total haul cost* is the sum of the variable costs and fixed cost; the unit cost will be the variable unit cost plus the fixed cost.

Total $/CY(Ton) = (1)Total Variable Cost / (2) Loose CY or Ton + Fixed Cost = (1) / (2) + _____ = $_____/CY(Ton)

Section 208. - STRUCTURE EXCAVATION AND BACKFILL FOR SELECTED MAJOR STRUCTURES

(Labor 50 percent)

Typical quantities of structure excavation range from 250 cy for small briges to 2000 cy for deep culvert replacements. Costs range from $20/cy for smaller quantities to $10/cy for larger quantities. Material type (larger boulders, solid rock, sandy soils) should be taken into consideration when estimating the cost of structure excavation. If applicable make a subsidiary allowance to this pay item for contractor quality control.

Dewatering and erosion control plans should be include under Section 157.

Section 211. - ROADWAY OBLITERATION

(Labor 40 percent)

Obliteration may range from merely ripping and scarifying the road surface, removing culverts, and rounding off the cutslope to complete removal of the road template and recontouring to the original natural profile. A laborer should be included to saw replacement slash and seed/fertilize behind the equipment.

This work is generally performed from the end of the road to the beginning. Estimator needs to consider the existing condition of the road. Clearing and excavation may be required to access the end of the road to perform the roadway obliteration with the required equipment.

Method	Closure Device	Mitigation	Cost Range* $/mile
Method 2	Gate	Outslope, seed, fertilize. Normal drainage. May treat noxious weeds.	$500-$1,500
Method 2	Gate, guardrail, concrete or earth barrier, or Recontour at intersection	Drain dips, drivable waterbars, or outslope. Scarify 2-3 inches, seed & fertilize. May scatter slash on roadway. May treat noxious weeds.	$1000-$2,500
Method 2	Recontour at intersection or rock or earth barrier	Waterbar or intermittent outslope. Remove CMP's & restore all watercourses to natural channels & floodplains. Rip 6-12 inches, seed and fertilize. May scatter slash on road. May treat noxious weeds.	$2,500-$3,500
Method 2	Recontour at intersection or Rock or earth barrier	Waterbar or intermittent outslope. Selective recontour along the road. Remove CMP's & restore all watercourses to natural channels & floodplains. Rip 12-18 inches, seed & fertilize. Scatter slash on recontoured slope. May treat noxious weeds.	$3,000-$7,500

*Costs do not include gates, guardrails, and concrete barriers.
*Costs include minor structure removal.
*Cost do not include weed treatment.

Method	Closure Device	Mitigation	Cost Range* $/mile
Method 1	Recontour	Recontour the entire road prism to almost pre-road conditions. Remove CMP's & restore all watercourses to natural channels & floodplains. Seed & fertilize. Scatter clash on recontoured slope. May treat noxious weeds.	$7,500 up

*Costs do not include gates, guardrails, and concrete barriers.
*Costs include minor structure removal.
*Cost do not include weed treatment.

Section 212. - LINEAR GRADING

(Labor 45 percent)

This section is intended for use on single purpose roads in relatively gentle/moderate and uniform terrain. It can be used in conjunction with most construction control methods. The specification combines clearing and grubbing, excavation, and erosion control.

The entire preconstruction effort including location, survey, design, and cost estimating should be consistent with the road standard, desired end product, and risk factor. A high degree of sophistication is not warranted when developing the cost estimate for this work.

Use of **Tables 212-1 through 212-4** on the following pages is quite appropriate and fits the intent of the specification. The tables consider each of the typical sections commonly used in the Region. The assumptions listed below were used in preparing the tables:

Assumptions used in Tables 212-1 through 212-4	
Clearing and Grubbing:	▪ Clearing limits = top of cut to toe of fill a minimum 25' width. ▪ Topographic factor - see Section 201.

Tables 212-1 and 212-2 show clearing cost for Government, purchaser, or cooperator-owned timber such as that found on timber sale contracts. On public works contracts, R/W timber should be decked by the contractor to be sold by the Forest Service. R/W timber volume value should not be made a consideration of bid for clearing items on public works contracts.

Note: Cost allowance for painting and branding of logs, where required, is considered incidental to clearing, no separate allowance is required.

Assumptions used in Tables 212-1 through 212-4	
Excavation:	▪ Self balanced sections. ▪ Compaction factor used (.25 to .75). ▪ No allowance for drain dips, finishing and/or shaping, slough widening, curve widening, turnouts, turnarounds, or haul. *(An additional allowance should be made for these items.)*

To determine costs, use the procedure outlined below. *Be sure to use the correct table for the appropriate road backslope, and road template.*

Step 1 Determine base Clearing and Grubbing Costs in dollars per mile by entering **Table 212-1** (for 3/4:1 backslopes) or **Table 212-2** (for 1:1 backslopes) with known values for sideslopes and right-of-way volume per acre. (Note: the minimum clearing width is 25 feet or 3 acres per mile.) Adjust the clearing cost by multiplying the base clearing and grubbing cost by the slash disposal adjustment and the widening factors.

Slash Disposals Factors:

Method	Factor
Windrowing	1.0-1.1
Scattering	1.15-1.35
Piling	1.3

Widening Factors (Clearing):

Method	Factor
No additional widening	1.0
Slough widening, turnouts, log truck curve widening, turnarounds	1.2

Step 2 Add allowance for Individual Removal of Trees – Section 201, Cost Guide.

Step 3 Determine base excavation costs in dollars per mile using **Table 212-3** with known values for backslopes and sideslopes. Adjust the excavation cost for materials, topography, and additional widening by multiplying the base excavation cost by the respective adjustment factors. Add additional cost for scarifying (if necessary), drainage dips, haul, etc.

Material Factor: (% Common)(1.0) + (%Loose Rock)(1.5-1.75) + (% Rip)(3.0) + (% Blast & Boulders)(5.0)

Topography Factor:

Method	Factor
Self balanced sections	1.00
Some through fills and free haul	1.25

Widening Factor (Excavation):

Method	Factor
No additional widening	1.00
Slough widening, turnouts, log truck curve widening, turnarounds	1.15

Drainage Dips: see Section 204

Haul: see Section 204

Total Excavation Cost = (Base Cost) x (Material Factor) x (Topography Factor) x (Widening Factor) + (Drainage Dips) + (Haul)

Step 4 Determine seeding cost in dollars per mile by using **Table 212-4**.

Step 5 Total results in steps 1, 2, 3, and 4 to determine unit cost.

Example Linear Grading Calculation

Location: Montana Zone 3
Length: 1.7 miles
Average side slope: 30 percent
R/W timber classification: Light-Med (15 MBF/Ac), Purchaser owned
Windrow construction slash
Hazard Trees: 12 (Total)
Excavation classification:
85 percent common
15 percent rip
0 percent blast
Template: 14 ft w/o ditch, 3/4:1 backslope, self balanced sections, no through fills or free haul. Allow for turnouts every 1,000 feet, normal curve widening, one turnaround per mile, and 4 drainage dips. Seed, dry method, without mulch.

Step 1: Base Clearing Cost = $8,350 per mile (Table 212-1)
Adjusted Clearing Cost:
Slash Disposal Factor = 1.0
Widening Factor = 1.2
Cost = $8,350per mile *1.0 *1.2 = $10,020 per mile

Step 2: Allowance for Removal of Trees Miscellaneous
12 Trees *$30 per tree / 1.7 miles = $212 per mile.

Step 3: Base excavation cost = $4,590 per mile (Table 212-3)
Adjusted excavation cost:
Material Factor = (0.85 *1.0) + (0.15 *3.0) + (0 *5.0) = 1.3
Topography Factor = 1.0
Widening Factor = 1.15
Drainage Dips = 4 @ $125/ 1.7 = $294 per mile
Cost = ($4,590 per mile *1.3 *1.0 *1.15) + $294 = $7,156 per mile

Step 4: Seeding Cost = $710 per mile (Table 212-4) (calculated under Section 625)

Step 5: Unit Cost = $10,020 + $212 + $7,156 + $710 = $15,152 per mile

Adjust for Zone 3 (labor, 45%): $18,098 per mile *1.00 = $18,098 per mile

Table 212-1
Clearing and Grubbing Cost per mile for Specification 212
Backslope: 3/4 : 1
Purchaser Owned R/W Timber

Road Template Sideslope %	Volume/ Acre	12 ft without Ditch	14ft without Ditch	12 ft with Ditch
0	5	$7,380	$7,380	$7,380
10	5	$7,380	$7,380	$7,380
20	5	$6,780	$6,780	$6,780
30	5	$6,780	$6,780	$6,780
40	5	$6,780	$7,020	$8,110
50	5	$8,830	$10,410	$11,860
0	10	$8,230	$8,230	$8,230
10	10	$8,230	$8,230	$8,230
20	10	$7,500	$7,500	$7,500
30	10	$7,500	$7,500	$7,500
40	10	$7,500	$7,750	$9,080
50	10	$9,920	$11,620	$13,310
0	15	$9,200	$9,200	$9,200
10	15	$9,200	$9,200	$9,200
20	15	$8,350	$8,350	$8,350
30	15	$8,350	$8,350	$8,350
40	15	$8,350	$8,590	$10,040
50	15	$11,010	$12,830	$14,640
0	20	$10,040	$10,040	$10,040
10	20	$10,040	$10,040	$10,040
20	20	$9,080	$9,080	$9,080
30	20	$9,080	$9,080	$9,080
40	20	$9,080	$9,440	$11,010
50	20	$12,100	$14,040	$16,090
0	25	$10,890	$10,890	$10,890
10	25	$10,890	$10,890	$10,890
20	25	$9,920	$9,920	$9,920
30	25	$9,920	$9,920	$9,920
40	25	$9,920	$10,290	$11,860
50	25	$13,070	$15,240	$17,420

Table 212-1 (Continued)
Clearing and Grubbing Cost per mile for Specification 212
Backslope: 3/4 : 1
Purchaser Owned R/W Timber

Road Template Sideslope %	Volume/ Acre	12 ft without Ditch	14ft without Ditch	12 ft with Ditch
0	30	$11,860	$11,860	$11,860
10	30	$11,860	$11,860	$11,860
20	30	$10,770	$10,770	$10,770
30	30	$10,770	$10,770	$10,770
40	30	$10,770	$11,130	$12,830
50	30	$14,160	$16,580	$18,870
0	35	$12,700	$12,700	$12,700
10	35	$12,700	$12,700	$12,700
20	35	$11,500	$11,500	$11,500
30	35	$11,500	$11,500	$11,500
40	35	$11,500	$11,860	$13,790
50	35	$15,240	$17,780	$20,320
0	40	$13,550	$13,550	$13,550
10	40	$13,550	$13,550	$13,550
20	40	$12,340	$12,340	$12,340
30	40	$12,340	$12,340	$12,340
40	40	$12,340	$12,700	$14,760
50	40	$16,210	$18,990	$21,660
0	45	$14,400	$14,400	$14,400
10	45	$14,400	$14,400	$14,400
20	45	$13,070	$13,070	$13,070
30	45	$13,070	$13,070	$13,070
40	45	$13,070	$13,550	$15,730
50	45	$17,300	$20,200	$23,110
0	50	$15,370	$15,370	$15,370
10	50	$15,370	$15,370	$15,370
20	50	$13,910	$13,910	$13,910
30	50	$13,910	$13,910	$13,910
40	50	$13,910	$14,400	$16,700
50	50	$18,390	$21,410	$24,440

Table 212-2
Clearing and Grubbing Cost per mile for Specification 212
Backslope: 1 : 1
Purchaser Owned R/W Timber

Road Template Sideslope %	Volume/ Acre	12 ft without Ditch	14ft without Ditch	12 ft with Ditch
0	5	$7,380	$7,380	$7,380
10	5	$7,380	$7,380	$7,380
20	5	$6,780	$6,780	$6,780
30	5	$6,780	$6,780	$6,780
40	5	$6,780	$7,620	$8,710
50	5	$9,920	$11,620	$13,310
0	10	$8,230	$8,230	$8,230
10	10	$8,230	$8,230	$8,230
20	10	$7,500	$7,500	$7,500
30	10	$7,500	$7,500	$7,500
40	10	$7,500	$8,590	$9,800
50	10	$11,010	$12,950	$14,880
0	15	$9,200	$9,200	$9,200
10	15	$9,200	$9,200	$9,200
20	15	$8,350	$8,350	$8,350
30	15	$8,350	$8,350	$8,350
40	15	$8,350	$9,440	$10,890
50	15	$12,220	$14,400	$16,450
0	20	$10,040	$10,040	$10,040
10	20	$10,040	$10,040	$10,040
20	20	$9,080	$9,080	$9,080
30	20	$9,080	$9,080	$9,080
40	20	$9,080	$10,410	$11,860
50	20	$13,430	$15,730	$18,030
0	25	$10,890	$10,890	$10,890
10	25	$10,890	$10,890	$10,890
20	25	$9,920	$9,920	$9,920
30	25	$9,920	$9,920	$9,920
40	25	$9,920	$11,250	$12,950
50	25	$14,520	$17,060	$19,600

Table 212-2 (Continued)
Clearing and Grubbing Cost per mile for Specification 212
Backslope: 1 : 1
Purchaser Owned R/W Timber

Road Template Sideslope %	Volume/ Acre	12 ft without Ditch	14ft without Ditch	12 ft with Ditch
0	30	$11,860	$11,860	$11,860
10	30	$11,860	$11,860	$11,860
20	30	$10,770	$10,770	$10,770
30	30	$10,770	$10,770	$10,770
40	30	$10,770	$12,100	$13,910
50	30	$15,730	$18,510	$21,290
0	35	$12,700	$12,700	$12,700
10	35	$12,700	$12,700	$12,700
20	35	$11,500	$11,500	$11,500
30	35	$11,500	$11,500	$11,500
40	35	$11,500	$13,070	$15,000
50	35	$16,940	$19,840	$22,860
0	40	$13,550	$13,550	$13,550
10	40	$13,550	$13,550	$13,550
20	40	$12,340	$12,340	$12,340
30	40	$12,340	$12,340	$12,340
40	40	$12,340	$13,910	$15,970
50	40	$18,030	$21,290	$24,440
0	45	$14,400	$14,400	$14,400
10	45	$14,400	$14,400	$14,400
20	45	$13,070	$13,070	$13,070
30	45	$13,070	$13,070	$13,070
40	45	$13,070	$14,880	$17,060
50	45	$19,240	$22,620	$26,010
0	50	$15,370	$15,370	$15,370
10	50	$15,370	$15,370	$15,370
20	50	$13,910	$13,910	$13,910
30	50	$13,910	$13,910	$13,910
40	50	$13,910	$15,730	$18,150
50	50	$20,450	$23,950	$27,580

Table 212-3
Excavation Cost Per Mile For Specification 212

Road Template Sideslope%	Backslope 3/4:1			Backslope 1:1		
	12 ft without Ditch	14ft without Ditch	12 ft with Ditch	12 ft without Ditch	14ft without Ditch	12 ft with Ditch
10	$3,850	$3,850	$3,850	$3,850	$3,850	$3,850
15	$3,850	$3,850	$3,850	$3,850	$3,850	$3,850
20	$3,850	$3,850	$4,280	$3,850	$3,850	$4,440
25	$3,850	$3,850	$4,910	$3,850	$3,940	$4,910
30	$3,850	$4,590	$5,990	$3,850	$4,870	$6,360
35	$4,300	$5,860	$7,640	$4,640	$6,320	$8,240
40	$5,430	$7,380	$9,640	$5,960	$8,100	$10,590
45	$6,840	$9,310	$12,160	$7,680	$10,450	$13,660
50	$8,450	$11,500	$15,020	$9,740	$13,250	$17,300

Table 212-4
Seeding Cost Per Mile for Specification 212

Road Template Sideslope%	Backslope 3/4:1			Backslope 1:1		
	12 ft without Ditch	14ft without Ditch	12 ft with Ditch	12 ft without Ditch	14ft without Ditch	12 ft with Ditch
0	$250	$260	$280	$260	$270	$290
5	$250	$260	$280	$260	$270	$290
10	$250	$260	$280	$260	$270	$290
15	$300	$350	$370	$330	$370	$390
20	$390	$440	$490	$420	$480	$520
25	$500	$570	$630	$530	$600	$680
30	$620	$710	$790	$690	$760	$850
35	$760	$860	$970	$850	$960	$1,080
40	$940	$1,070	$1,210	$1,060	$1,210	$1,360
45	$1,180	$1,360	$1,510	$1,340	$1,540	$1,740
50	$1,510	$1,730	$1,960	$1,730	$2,010	$2,280

Note: Seeding cost does not include the roadbed. Seeding cost does not consider native seed, if native seed is required, contact supplier for costs and availability.

End of Division 200 Earthwork

DIVISION 250 SLOPE REINFORCEMENT AND RETAINING WALLS

Section 251. - RIPRAP

Hand-Placed Riprap (Labor 45 percent)
Dumped Riprap (Labor 30 percent)
Machine-Placed Riprap (Labor 20 percent)
Sacked Soil Cement (Labor 60 percent)
Sacked Concrete (Labor 60 percent)
Wire-Enclosed Riprap (Labor 75 percent)

Riprap must be estimated on an individual basis due to such a variety in size, shape, and difficulty of installations. Unit costs are to include furnishing, placing, and haul of riprap. Also includes cost of woven wire, lacing or tie wires, stakes, and labor to place and enclose riprap.

- Calculate haul cost using prices listed in the haul section of this cost guide.
- Development of the pit or source if required should be calculated using time and equipment.
- Royalty charge in private pits obtained from pit owner - see Section 301 or 641.
- Drilling and blasting cost of quarries (if required) - see Section 301 or 641.
- Access road development, if required - use time, and equipment.
- Geotextile, if used - estimate material prices and pay under Section 207.
- Where applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 253. - GABIONS AND REVET MATTRESSES

This installation cost must be estimated on an individual basis. The variety of sizes available and design needed can change costs. Equipment needed and cost of rock must be considered. Use time, material, and equipment to determine cost and % labor for this item. When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 255. - MECHANICALLY-STABILIZED EARTH WALLS

(Labor 40 percent)

Each project is unique and must be estimated on material, labor, and equipment basis. When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 257. - ALTERNATE RETAINING WALLS

This item must be estimated on an individual basis. The variety of types and the site conditions can affect the unit costs. Use time, material, and equipment to determine cost and % labor for this item. When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Types available include:

- Steel Bin Retaining Wall
- Culvert Retaining Wall
- Chain Link
- Gabion
- Treated Timber Bins
- Treated Timber-Faced Wall
- CRIBLOCK (Concrete bins)
- Fabric Wall
- Reinforced Concrete (tie-back/cantilever)
- Treated Timber Lag Wall
- HILFIKER (Welded Wire)

End of Slope Reinforcement & Retaining Walls

DIVISION 300 AGGREGATE COURSES

Section 301. - AGGREGATE COURSES

Note: If local conditions indicate that aggregate production will be subcontracted, and that aggregate producers will likely pay Davis-Bacon wage rates, no reduction for labor should be made to the basic rock cost. Also, not all contracts require Davis Bacon rates in basic rock and hauling costs. Check with your Contracting Officer.

The costs shown herein are applicable only for situations closely fitting the stated assumptions. However, the procedure and work items should be considered and estimated for all projects where that type of work is involved. On larger base and surfacing projects of 25,000 CY or more, consideration should be made for additional economies due to the large quantities. Total in place cost for these large jobs will average about *10% less.* On the other hand, for small projects of 5,000 CY or less, costs will be at least *20% higher*.

Aggregate costs estimates are broken down by:

- Basic Rock Cost
- Load and Apply
- Haul

Basic Rock Cost

(Labor: 45 percent)

The following costs assume a production rate of l50 TPH. Material weighs 2,800 to 3,000 lbs/CY loose. Costs shown are in tons and loose cubic yards. Material Grading C, 1-1/2 inch minus.

- **Move-in/move-out** (approximate) Includes cost to set up and take down equipment. Does not include movement of equipment commonly used on other parts of job. Make cost allowance per instructions under Section 151 (Mobilization).

Screened	Crushed Pit Rock	Crushed Quarry Rock
$4,000	$9,000	$15,000

For platform scale add $2,000 to $2,500 (includes move-in, set-up, ramps, and certification). If belt scales will be used, make an allowance of $500-1,500 for certification.

- **Pit development** Estimate pit or quarry development under Section 641, cost may be included in basic rock cost or as a separate pay item.

Costs should include:
Clearing, grubbing, and slash cleanup
Access roads
Conserving topsoil
Removal of overburden
Ground control and traffic control
Restoration
Seeding

- **Royalty charge** for private pits. These are highly variable, costs range from $.50/CY to $1.00/CY or higher.

- **Drilling and shooting**

Method	ID and MT
Normal drilling and shooting: (includes tractor for moving material)	$1.60/CY loose
	$1.10/ton
Breaking oversize	$5.00/CY loose
	$3.50/ton

- **Ripping** **ID and MT**
  $1.17/CY
  $0.78/ton

- **Crushing** For grading other than ***Grading C***, the following multipliers should be applied to crushing costs shown below for pit rock or quarry rock.

Gradation Factor
US Customary (English) Units

Max Size (in)	3"	2"	1 -1/2"	1"	3/4"	3"	2"	1-1/2"	1"	3/4"	6"	4"	3"	2"
Grading	A	B	C	D	E	F	G	H	J	K	L	M	N	O
Multiplier	0.9	0.95	1.00	1.10	1.25	0.80	0.9	0.95	1.05	1.20	0.6	0.7	0.7	0.7

	ID and MT
Crushed pit rock (drilling and shooting and/or ripping generally not required)	$4.50/CY loose
	$3.30/ton
or	
Crushed quarry rock (includes loading into crusher)	$5.35/CY loose
	$3.85/ton

Note: If size-ratio requirements are included in the grading, increase crushing costs approximately 10%.

Bentonite Binder: If bentonite binder is specified at 2% of aggregate quality, add $2.00 per ton ($2.20 per metric ton) to rock cost for projects over 10,000 tons (9,070 metric tons) and $3.00 per ton ($3.31 per metric ton) for smaller projects.

- **Screening only** **ID and MT**
  $2.70/CY loose
  $2.05/ton

- **Pit run** (no crushing - includes dozer, loader, and operators) **ID and MT**
  $2.10/CY loose
  $1.45/ton

- **Stockpiling** (use only where required by contract or job conditions) **ID and MT**
  $0.90/CY loose
  $0.65/ton

- **Weighting:** (Platform Scales) **ID and MT**
  $0.27/ton

- **Contractor Quality Control:** (If required by contract, add the cost of contractor sampling and testing. See Section 153.)

Production Losses
In computing aggregate costs, one should calculate the total cost of producing the final quantity of aggregate desired. To determine unit costs, the total costs of each major subdivision (basic rock cost, load and apply, and haul) should then be divided by the final desired quantity. By following this procedure, the cost of normal production losses can be included in the unit cost of the final quantity.

The following production losses should be considered:

- **Ongrade process and haul losses**: essentially negligible for conscientious operator.
- **Stockpiling losses**: Approximately 5 percent; use only if stockpiling required by contract, physical arrangement of pit, or work schedule imposed by contract.
- **Crushing/screening/blasting**.
  Quarry operation approximately 5-10 percent.
  Gravel or rock pit - 20-30 percent

These seemingly high losses result from a high percentage of fines found in such pits. Technically, it is not "lost" material, but "reject" necessitated by gradation requirements. Actual estimate of losses should be based on field tests or experience.

Small Quantities
Increase costs for small projects as calculated above by about 20% for jobs where the quantities are less than 5,000 tons or 3,500 CY.

Example Basic Rock Calculation

Grading D, compact by hauling equipment.
Quantity required on the road - 10,000 tons
Location: Idaho (Area 2, Zone 2)
Assume hard rock quarry with stockpiling and weighing required.
Stockpiling loss - 5 percent
Crushing loss - 10 percent

To obtain 10,000 tons for the road, the contractor will have to drill, shoot, and process approximately 11,500 tons (10,000 + 15% = 11,500 tons).

Contractor will stockpile 10,000 tons + 5% = 10,500 tons.

Move in-out (includes platform scale) $17,000 - Include under Section 151 - Mobilization.

Drill and shoot $1.10*11,500	$12,650.00
Crushing and screening $3.80 * 11,500 * 1.1	$48,070.00
Stockpiling $0.65 * 10,500	$ 6,825.00
Weighing $0.27 * 10,000	$ 2,700.00
Contractor sampling & testing (lump sum)	$ 3,000.00
Total Cost	$73,245.00

Unit basic rock cost = $\frac{\$73,245.00}{10,000 \text{ tons}} = \$7.32/\text{ton}$

Adjust for Idaho Area 2, Zone 2, 45% labor; $7.32 X 1.01 = $7.39/ton

Load and Apply

(Labor = 40 percent)

- **Loading** costs are variable depending on procedures at pit. These vary depending on loading method.

Loading Method	ID and MT
from belt (included in basic rock cost)	$0
from hopper (included in basic rock cost)	$0
pit run (included in basic rock cost)	$0
from stockpile	$0.98/CY loose
	$0.72/ton

- **Initial Spreading** (knocking down piles and rough grading if needed) **ID and MT** $0.56/CY loose $0.40/ton

- **Grid rolling** (approximate) **ID and MT** $0.66/CY loose $0.52/ton

- **Grading of Aggregate base or surface course**(approximate) **ID and MT** $0.80/CY loose $0.56/ton

- **Compaction** (approximate) **ID and MT**
  With hauling equipment $0
  With rollers $0.59/CY loose $0.46/ton

- **Watering:** Estimate under Section 160; water should be incidental to Section 301, unless Forest has sufficient contract administration personnel for inspection of watering as separate pay item.

Aggregate Haul

(Labor = 30-50 percent)

Estimate haul under Section 204. These costs are based on loose cubic yards. Use appropriate weight conversion factor to convert to $/ton-mi. If measurement for payment or credit is on another basis, appropriate adjustment factors must be made.

If Construction Induced Maintenance is needed, it should be included in aggregate haul costs.

Example Aggregate Haul Calculation

Given: Variable costs of haul (based on road characteristics) and average round trip travel speed
3.0 miles @ 30 mph
6.0 miles @ 15 mph
2.5 miles @ 10 mph (include distance to turnaround)
Location: Idaho - Area 1 (Zone 2)

Belly dump trucks (20 CY)
Density: 1.4 tons per cubic yard
Basis of payment: ton

Haul Cost = Fixed cost + (variable haul cost x haul distances)
Haul Cost = 0.65 + ($0.45 * 3.0) + ($0.94 * 6.0) + ($1.39 * 2.5) = $11.12/ton
Adjust for Idaho Area 1 (Zone 2) (35% Labor): $12.02 x 1.00 = $11.12/ton

Section 303. - ROAD RECONDITIONING

(Labor 40-60 percent)

Normally, the majority of "reconditioning" work should be done with a grader with some minor blasting and/or tractor work for localized rock problems. More extensive work should be covered in the appropriate sections.

Good field classification and design will usually avoid the problem of calling for use of this specification when more appropriate work items may be needed. Other examples can be traced to situations where, through years of maintenance a roadway has been widened and shifted slightly away from the original alignment. Trees that used to be outside the shoulder by 5-10 feet, were eventually cut down for safety reasons, but the *stumps remain* in what now is the shoulder.

Estimator should also watch out for *subgrade boulders* which were originally well covered by native subgrade material, but the covering is now thin or absent.

- **Removing Slides** - Use time and equipment costs. (Estimate all slides in excess of l0 cubic yards per station under Section 204).

- **Pull ditches** with grader and clean catch basins **ID and MT** $350/Mile

- **Scarifying and shaping** (for ID and MT - $/mile)

	Single Lane	Double Lane
Average	$1,040	$1,370
Heavy	$1,600	$2,150

- **Finish grading with blade**

	ID and MT
Single Lane	$390/Mile
Double Lane	$525/Mile

- **Compaction** (for ID and MT - $/mile)

Method	Single Lane	Double Lane
B	$270	$350
C	$405	$625
D	-0-	-0-
E	$270	$350

- **Water** - Estimate under Section 160 or include in Section 303 as incidental.

- **Constructing New Ditch** - Include under Section 204.

- **Erosion Control Measures** - Include under Section 157.

- **Clearing and Grubbing** - Include under Section 20l.

- **Asphalt and Aggregate Surfaces** - Estimated using Sections 204, 301, 404, 414, and 430.

- **Contractor Quality Control** - Where applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 306. - DUST PALLATIVE

(Contract Item)

Refer to current dust palliative manufacturer and geotechnical engineering information for detailed information on product characteristics, application rates, estimating procedure, conversion factors and calculations. If product is unavailable locally, recommendations and information are available from the RO Materials Engineering. The following is a summary of essential information.

- **Application Rates.** See Application Rate Tables in Standard Specification for Construction of Roads and Bridges on Federal Highway Projects, FP-03. Rates for lignin sulfonate and chloride products are based on the solid contents shown below, "*Approximate Weight-Volume Factors @ °F*". These products may be furnished with varying amounts of water and if so, adjustments based upon the weight of solids may be necessary on the application rates and payment. Rates will vary depending on the type and condition of the surface and the amount of residual dust abatement material present. For example, more dust abatement material will be required for loose pit-run gravel and less for unsurfaced roads in clay material. Due to leaching of the chloride products, it is recommended that the product be applied *slightly narrower in width* than the surfacing, particularly along *riparian areas*.

Approximate Weight-Volume Factors @ 60°F

Material	Gallons/Ton	Pounds/Gallon
Lignin Sulfonate (50 percent solids, 1.26 S.G.)	190	10.51
Magnesium Chloride (32 percent solids, 1.317 S.G.)	182	10.98
Calcium Chloride (38 percent solids)	171	11.69

- **Unit Material Cost.** Prices can be extremely variable, particularly for dust oils. Up-to-date quotes should be obtained from local suppliers for each project.

- **Shipping Costs**: Shipping costs are variable and should be verified for each project.

- **Road Preparation:** Road preparation costs will depend on the existing surface condition, requirements in other Sections such as 301 or 303, and the method specified. See Section 303 for grading costs and Section 160 for watering.

- **Application Cost:** Typical application costs are $25 to $85 per M-Gals ($5 to $15 per ton) of liquid, depending on the type of distributor.

Section 321. - ROAD SURFACE STABILIZATION

(Contract Item)

See R1 Forest Service Supplement for roadbed preparation and material application rate. Estimate road preparation costs using time and equipment and materials application costs from supplier.

End of Division 300 Aggregate Courses

DIVISION 400 ASPHALT PAVEMENTS AND SURFACE TREATMENTS

Section 400. - ASPHALT PAVEMENTS AND SURFACE TREATMENTS

General: Contractor Quality Control and Testing - All allowances shall be subsidiary to other pay items. Generally contractor quality control is applicable for Items 403 through 406, 409, 410, and 412. Contractor sampling is applicable for Items 407, 408, and 413. Refer to FSSS 154 for details. Obtain costs from local supplier.

Section 403. - HOT ASPHALT CONCRETE PAVEMENT

(Contract Item)

Estimates should be based upon current local prices, remoteness and size of project, haul distance of materials, adequacy of worksite, etc.

Compare the cost of on-site production with feasible commercial sources in the area. Move-in and move-out costs of a portable plant will often control prices on small projects.

The in-place compacted density and asphalt content used for calculating quantities should be based on a preliminary mix design. In lieu of other information, use 150 pounds per cubic foot for in-place compacted density and 6.5 percent asphalt cement based on weight of total mix.

Increase cost of asphalt if antistriping additive is required.

Section 409. - ASPHALT SURFACE TREATMENT

(Contract Item)

Aggregate. Costs are dependent upon quantity and location. Include the following:

Crush and Stockpile: (See Section 301) Crushing costs can vary widely depending on the gradation selected, whether aggregates are produced as a by-product of other crushing operations or produced separately, and availability of commercial sources.

Chips: average weight is 2300 lbs/cy (loose).

Loading Aggregate: (See Section 301)

Weighing: (platform scales) Include cost for scale move-in, set-up and certification (See Section 151). If bin or belt scales are used, allow $500-$1000 for certification. For small projects consider using lump sum or cubic yard measurement.

Hauling: (See Section 204)

Road Surface Preparation, Brooming & Other Prep Work: (if req'd) Estimate the number of passes for power broom. (Travel speed of 5-7 miles per hour).

Aggregate Application: Include cost of self-propelled aggregate spreader and truck time while waiting and spreading.

Rolling: Immediately after application of aggregate. Estimate using pneumatic-tired roller (self-propelled).

Traffic control: Determine if traffic count and type of traffic warrant the need for pilot car and/or flag persons. Special or unusual construction signing should also be considered.

Surface Maintenance: Determine maintenance and brooming during and at the end of the curing period.

Temporary Centerline Marking: (See Section 634)

Bituminous Material: Obtain current quotes from local suppliers. Asphalt costs are dependent upon quantity and location.

Refer to the FP-03 specifications for Application Rates for emulsified and liquid asphalts.

Consider location of tanker trucks or temporary storage tank and time to re-fill distributor. Small, irregular areas such as in campgrounds or parking areas should be estimated using hourly rates for a distributor and hand spraying.

Increase cost of asphalt if antistriping additive is required for cut-back asphalts.

Bituminous Surface Treatments and Seal Coats Using Emulsified Asphalts: Refer to the FP-03 specifications for Application Rates for emulsified and liquid asphalts.

For estimating use the highest rates for aggregate and asphalt emulsion shown for the type of treatment desired.

Final rates should be determined by testing the aggregate after contract award - coordinate with RO Materials Engineering Center for assistance.

Use rock size (gradation) that is similar to local State requirements to obtain more competitive bids.

For campgrounds and administrative sites that have a buildup of dirt and pine needles along the shoulder, increase the costs for cleanup.

Section 410. - SLURRY SEAL

(Contract Item)

Obtain costs from supplier.

Section 411. - ASPHALT PRIME COAT

(Contract Item)

Obtain current quotes from local suppliers. Asphalt costs dependent upon quantity and location.

Section 412. - ASPHALT TACK COAT

(Contract Item)

Obtain costs from local supplier. Costs dependent upon quantity and location. Ensure surface preparation and brooming cost are included in quoted price, if not make allownaces for this work.

Section 414. - ALPHALT PAVEMENT CRACK AND JOINT SEALING
(Contract Item)

Obtain costs from local supplier.

Section 415. - PAVING GEOTEXTILES
(Contract Item)

Obtain costs from local suppliers.

Section 431. - SEAL FOR LIGHT TRAFFIC PAVEMENTS

Refer to the user notes for the most recent Regional supplemental specification 417 for detailed information on what application rates and options to select based on your project conditions and the desired surface. Cost vary contingent on cost of materials, size of project and condition of pavement. Unit prices should be less for projects over 10,000 square yards and higher for smaller irregular shaped areas that are at least partially covered with duff and pine needles.

Contacting local contractors is recommended if an accurate estimate is desired. Contractors are listed in the Yellow Pages under "Asphalt and Asphalt Products", and under "Pave Materials". When discussing your project with them, the following items should be reviewed.

- The specification requires seal material conforming to Section 417.02. Proprietary products like Seal Master, Tuff Coat, and PermaSeal have met this spec on past projects. If they are not familiar with the spec, you should FAX them a copy.
- Your project size and payment quantity is expressed in square yards, and not square feet.
- The specification application rates are in pounds solids per square yard, and not gallons per square yard.
- A site visit by a local contractor is preferred, so they can get a better idea of the amount of crack filling, pavement surface cleanup required, and etc., etc., needed.

Section 432. - ASPHALT PAVEMENT PATCHING
(Contract Item)

Obtain costs from local suppliers.

End of Division 400 Asphalt Pavements and Surface Treatments

DIVISION 550 BRIDGE CONSTRUCTION

Cost Estimating Bridge Construction For Programming

Use the methods and unit costs shown in this section to estimate bridge costs. Cost figures include bridge superstructure and substructure costs, "curbs only" railing system (no approach guardrail), riprap, bridge removal, normal erosion and pollution control work, and nominal approach roadway work (~ 5% to 10% of bridge costs).

Currently, 90% of new or replacement bridges have a spill-thru type configuration (trapezoidal stream channel opening). For spans up to 40 feet, concrete, timber or steel bridges are all competitive alternatives. For spans above 40 feet, concrete is primarily the most competitive alternative, but steel is also being used in certain instances.

For spill thru bridge configurations, the span length (S), can be estimated if the "bankfull" dimension (BF), and height (H) from finish grade to stream bed is known. Span length will be approximately, S = BF+ 5 +(3*H). If scour potential is low, abutments are typically concrete caps perched above the stream in the approach fill. If scour potential is high, abutments will be piling or deep spread footing founded below the stream bed.

Use the following to estimate bridge costs.

- **Spans up to 40 feet ($/LF):**

Single Lane	Double Lane
$2000 - $2500	$2500 - $3000

- **Spans greater than 40 feet($/LF):**

Single Lane	Double Lane
$2500 - $2750	$3000 - $3250

- **Bridge Rail/Guardrail:** Add $100/LF of bridge for bridge rail and $10,000 for approach guardrail if needed.
- **Piling/Deep Spread Footings:** Needed due to high scour potential, add $30,000 for single lane bridges and $40,000 for double lane bridges.
- **A/E Design:** Add 15% for A/E design costs to include site surveys, preliminary report, and final design.

Costs can vary greatly depending on the general approach conditions, BMP work, and stream channel work that might be included. Questions should be directed to the Transportation Structures Group, John Kattell (406-329-3324).

Section 551. - DRIVEN PILES

(Contract Item) - No metric conversion for Bridge Construction Items

Type of Pile	Treated Timber	Steel
Furnished Pile Cost	$35/LF	$40/LF(HP10x42)
		$45/LF(HP12x53)
Drive Cost (Depends on quantity)	$55 – 70/LF	$55 – 70/LF
Shoe Cost	$150/ea	$225/ea

When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 552. - STRUCTURAL CONCRETE
(Contract Item)

$600 to $1000 per cubic yard - Depending on haul and quantity

When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 553. - PRESTRESSED CONCRETE
(Contract Item)

Multi-Beams (Includes Installation)

Tri Deck		$60/SF
Bulb Tee	3' to 4'6"	$60/SF
	5' to 5'6"	$75/SF
Concrete curb		Add $45/LF

When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Section 554. - REINFORCING STEEL
(Contract Item)

Large jobs	$1.75/lb
Small jobs (under 1000 lbs)	$2.00/lb

Section 555. - STEEL STRUCTURES
(Contract Item)

Section 556. - BRIDGE RAILING
(Contract Item)

Timber Glue Lams	$150/LF
Double layer flexbeam	$ 75/LF
Single layer flexbeam w/timber	$ 60/LF
Double box tube (Concrete Deck)	$ 125/LF
Double box tube (Timber Deck)	$ 125/LF
Single box tube	$ 60/LF
Approach Rail	$ 60/LF
Breakaway Cable End Anchorage	$500/Ea
Buried End Anchorage	$500/Ea
Terminal Section	$300/Ea

Section 557. - TIMBER STRUCTURES

(Contract Item) or (R-l Treated Timber Standards - Labor 45 percent of installation cost only)

TIMBER MATERIALS

Material Description	$/MBFM
Solid sawn (up to 3 inches thick)	$1750
Heavy	$3000
Treatment	add 20%
Glue Laminated	$3100
Treatment	add 35%
Timber Hardware	add 1.5%
Treated Structural Timber (installed)	$4000
Treated Structural Glu-lam Superstructure (installed)	$6000
Treated Structural Glu-lam Substructure (installed) (vertical timber wall abatements)	$7000

When applicable, make a subsidiary allowance to this pay item for contractor quality control

End of Division 550 Bridge Construction

DIVISION 600 INCIDENTAL CONSTRUCTION

Section 601. - MINOR CONCRETE STRUCTURES

(Labor 40 percent)

Method A or B: Concrete for minor structures (about 30 CY or less). Unit price may vary from $400 to $500 per CY, depending upon quantity, distance from concrete source, forming difficulty, etc. Where applicable, make a subsidiary allowance to this item for contractor quality control.

Method C: Very small quantities of concrete for fence posts, gate post, etc. (no forms required). Cost will be about $100/CY or greater, depending on number of sites, access, etc.

Section 602. - CULVERTS AND DRAINS

Labor for culverts to and including 36 inches in diameter and CMPA's to and including 42 inches by 29 inches: compaction Method A, 30%; compaction Methods B and C, 40-60 %. Labor for larger culverts and CMPA's: 40-60%. Method A should not be used for these pipe sizes.

Average unit costs for metal culverts in this guide may be used without adjustment for projects having culverts in excess of 10,000 pounds total. For quantities less than 10,000 pounds, an additional allowance for material only (not installation costs) should be made using the following factors:

To 5,000 lbs, factor = 1.35 5,000 - 10,000 lbs, factor = 1.25

Note: There are 3 compaction conditions, Methods A, B, and C noted in the standard specification and FSSS 209.11. The unit prices shown in this Section need to be adjusted for the compaction method and quality control as follows:

Compaction Method:

Method A. Multiply unit costs by 0.90.
Method B. No adjustment.
Method C. Multiply unit costs by 1.10.

Quality Control:

Where applicable, make a subsidiary allowance to this pay item for contractor quality control.

Costs for *excavation* for culverts 36" and smaller in diameter and for CMPA's 42" x 29" and smaller are included in the table below. Unit cost for culverts installed in existing roads and pipes installed "after grade" will normally be higher than for pipes in new construction due to the increased amount of excavation. The following culvert prices which include bands should be used for the condition indicated:

Size	New Construction ID and MT* ($/LF)**	"After Grade" & Reconstruction (Shallow Installation) ID and MT* ($/LF)**
18"	$29	$32
24"	$38	$40
30"	$48	$51
36"	$59	$62

***In Montana** Material Costs may be higher, check with local suppliers. Include costs for **all required permits** under Section 151.

****Longer lengths or Steep side slopes:** Increase the above costs by a factor of 1.1 to 1.3 to reflect longer lengths or steepness of side slopes.

Larger Pipes: Estimate larger pipes by time and equipment methods. Following are some items that should be considered under Sections 602 and 208 when estimating installation of larger pipes:

- Analyze the cost of materials for different culvert corrugations. Often a lighter metal thickness can be used with the wider corrugations which may result in a savings in materials costs.
- Allow costs for metal end sections, culvert end treatments, shop ellipsing, special coatings, and adjustment for pipe arches if required. Call culvert suppliers for quotes.
- Estimate the amount of time and equipment required (excavation equipment, compaction equipment, labor, operators, etc.) to excavate and construct the culvert bed including excavation below the invert elevation for removal of unsuitable or unstable material and to bed and backfill the pipe (compaction method C). Allow time for diversion of the stream and cost for special materials or equipment needed for diversion such as plastic sheeting, piping, pumps, etc. Check results against bid history.
- If springs, seeps, or underground flows are expected in the culvert area, allowance should be made for filter cloth, drain rock, cutoffs, special bedding, or special backfill material.
- Costs for excavation of culverts larger than 36 inches or the squash equivalent is not included in the cost for the culvert under Section 602. The cost for this type of excavation would be estimated under Section 208 Structure Excavation. Bedding material for culvert backfill ranges from $10 to $25/CY, actual cost will depend on haul distance, excavation conditions, etc.

Culvert Material Base Price

The following materials and shop prices are provided as a guide for use in estimating culvert prices (based on truck load quantities). Due to the volatility of steel prices, material costs should be checked with local suppliers. Local suppliers' prices and discounts may be substituted, if available.

Polyethylene Corrugated Pipe

Polyethylene Corrugated Pipe
20 Foot Sections

Double Wall Rigid	
Size (inches)	***Cost/ft***
12	$5.81
15	$9.30
18	$12.86
24	$22.13
30	$30.27
36	$40.54
42 (bell & spigot)	$43.72
48 (bell & spigot)	$55.37

Corrugated Metal Pipe

Corrugated Metal Pipe
2.66"x1/2" Corrugations

Thickness	*Size (inches)*	*$/ft*	*lb/ft*	*Thickness*	*Size (inches)*	*$/ft*	*lb/ft*
0.064	12	$10.02	10	0.079	18	$23.98	18
(16ga)	15	$12.01	12	(14ga)	24	$31.74	24
	18	$15.04	15		30	$41.34	30
	24	$21.77	19		36	$49.43	36
	30	$27.50	24		42	$66.76	42
	36	$33.23	29		48	$73.06	48
	42	$37.59	34		54	$80.41	54
	48	$41.99	38				
Thickness	*Size (inches)*	*$/ft*	*lb/ft*	*Thickness*	*Size (inches)*	*$/ft*	*lb/ft*
0.109	24	$47.39	33	0.138	60	$154.42	103
(12ga)	30	$59.15	41	(10ga)	66	$168.72	113
	36	$70.63	49		72	$185.01	123
	42	$82.13	57				
	48	$93.74	65				
	54	$107.15	73				
	60	$119.41	81				
	66	$131.27	89				

Corrugated Metal Pipe
3"x1" and 5"x1" Corrugations

Thickness	*Size (inches)*	*$/ft*	*lb/ft*	*Thickness*	*Size (inches)*	*$/ft*	*lb/ft*
1.064	42	$51.48	39	0.109	54	$109.56	83
(16ga)	48	$58.08	44	(12ga)	60	$121.44	92
	54	$66.00	50		66	$133.32	101
	60	$72.60	55		72	$145.20	110
	66	$79.20	60		78	$157.08	119
	72	$87.12	66		84	$168.96	128
	78	$93.72	71		90	$180.84	137
	84	$101.64	77		96	$194.04	147
					108	$217.80	165
					120	$241.56	183
Thickness	*Size (inches)*	*$/ft*	*lb/ft*	*Thickness*	*Size (inches)*	*$/ft*	*lb/ft*
0.079	42	$62.04	47	0.138	108	$278.52	211
(14ga)	48	$71.28	54	(10ga)	120	$308.88	234
	54	$80.52	61		132	$341.88	259
	60	$88.44	67		144	$372.24	282
	66	$97.68	74				
	72	$106.92	81				
	78	$114.84	87				
	84	$124.08	94				
	90	$132.00	100				
	96	$141.24	107				
	102	$150.48	114				
	108	$158.40	120				

Coupling Bands - Equivalent cost: Up to and including 72″ diameter = 2′ of pipe
Greater than 72″ diameter = 3′ pipe

Arched pipe: More than 100' of one diameter, add 15 percent. Between 30 to 100' of one diameter, add 25 percent, less than 30' of one diameter add 40 percent.

Culvert Pipe End Treatment: (does not include material).

Diameter or equivalent Span & Rise (inches)	*Price per cut (skew or bevel)*
18	$27.00
24	$36.00
30	$45.00
36	$54.00
42	$63.00

Diameter or equivalent Span & Rise (inches)	*Price per cut (skew or bevel)*
48	$72.00
54	$81.00
60	$90.00
66	$99.00
72	$108.00

Five Percent Shop Ellipse: (same cost additions as for arch pipe) Call for quotes.

Special Coatings: Call culvert distributor for quotes.

End Sections (Flared End Terminal Sections):

Diameter of pipe (inches)	*Gage*	*Price (ea.)*	*Galvanized Weight (lbs)*
12	16	$90.49	28
15	16	$114.61	36
18	16	$154.29	50
24	16	$224.74	76
30	14	$451.37	157
36	14	$685.92	209
42	12	$1106.03	430
48	12	$1284.72	509
54	12	$1520.54	630
60	12/10	$2046.11	826
72	12/10	$2469.89	998
84	12/10	$2999.84	1200

Dimensions of Arch (inches)	*Gage*	*Price (ea.)*	*Galvanized Weight (lbs)*
17x13	16	$124.19	30
21x15	16	$144.50	37
28x20	16	$215.33	60
35x24	14	$360.76	109
42x29	14	$579.60	165
49x33	12	$910.75	276
57x38	12	$878.68	361
64x43	12	$2010.06	520
71x47	12/10	$2451.96	790
77x52	12/10	$3177.88	818
88x57	12/10	$3420.49	887

Section 603. - STRUCTURAL PLATE STRUCTURES

(Labor 20 percent)

Costs do not include the cost of the footing, structural excavation, embankment, or riprap. Each project should be estimated on material, time, and equipment basis. When applicable, make a subsidiary allowance to this pay item for contractor quality control.

Call for quotes on material cost.

Section 604. - MANHOLES, INLETS, AND CATCH BASINS

(Labor 25 percent)

Call culvert manufacturer for prices. Use time and equipment for installation.

Section 605. - UNDERDRAINS, SHEET DRAINS, AND PAVEMENT EDGE DRAINS

(See items below for labor and reductions)

Underdrains: Perforated pipe $/LF (Labor 40 percent). Add 15 percent to standard culvert price.

Special sections: Material cost is per table below. The labor cost in the table is a production cost; therefore should not be reduce. Material costs for bands are in Section 602. Labor for installation of the bands will need to be added. Add 20% for arch pipe fittings.

Diameter inches	*Elbows (30-90 degrees) Labor Cost (ea.)*	*Wyes & Tees Labor Cost (ea.)*	*Material ($/LF)*
6	$50.00	$50.00	$13.90
8	$72.85	$87.42	$13.90
12	$72.85	$87.42	$13.90
15	$93.12	$111.74	$17.12
18	$124.51	$149.41	$20.35
24	$243.21	$291.85	$27.15

Porous backfill(filter material) (Labor 10 percent): Develop price from rock costs plus the haul cost as determined from the chart in haul section of the cost guide. Haul cost to be estimated from the nearest point of manufacture.

Geotextiles (Labor 10 percent): When using geotextiles, the pipe must be placed in open graded porous material.

Granular underdrain (Labor 25 percent): The cost of granular underdrain is normally on a CY basis which includes cost of production, loading, hauling, spreading, and compaction. Develop cost by using same criteria as used for Section 301 (screened material).

Sheet Drains (Labor 30 percent): Due to the variable nature of availability, type and gradation of the rock, the different geotextile materials that may be specified, and the different site conditions that may be encountered this work should be estimated using the "time and equipment" estimating procedures.

Section 606. - CORRUGATED METAL SPILLWAYS

(Labor 20 percent)

Use time, material, and equipment.

Round Pipe: If round pipe is used, 70 percent of the unit price in Section 602 will apply, unless difficult slope conditions are encountered.

Elbows: Include two connecting bands.

Anchors: Estimate by material and time.

Berm Drain: Unit cost consists of installation of prefabricated corrugated metal catch basin 12" diameter with slip joint and 20 feet of 8" corrugated metal downspout with downspout anchors.

Flexible Downdrain: Lowest price for larger quantity of 200 or more lineal feet.

Inlet assemblies: Estimated the same as Section 602, End Sections. Inlet assemblies are measured by the number installed and accepted.

Downpipe: Measure the quantity of lineal feet installed including accessories except inlets. Estimates should include gaskets and anchors. An 18" downpipe with all accessories will cost about $60/LF installed.

Anchors: Required for downpipes. Anchors should be placed approximately every 10 feet and at the outlet. A culvert anchor installation may consist of stakes and bands or two metal fence posts and wire. The metal fence post culvert anchor may be used for downpipe up to 30" in diameter. 30" diameter pipe and larger will require anchors especially designed for them.

Section 607. - CLEANING, RECONDITIONING, AND REPAIRING EXISTING DRAINAGE STRUCTURES

(Labor 75 percent)

Caution needs to be taken in using this item on metal culverts that have any significant age and or deterioration. Unit price should take into consideration costs related to removing, cleaning, relaying and/or stockpiling pipe.

Excavation for removing pipe should be estimated at the unit price for culvert excavation, or use time and equipment. Removing, cleaning, and relaying of pipe should cost approximately 70 percent of the in place price per foot for new construction for a given size of pipe as listed in Section 602.

Section 609. - CURB AND GUTTER

(Labor 40-50 percent)

Use time, materials, and equipment estimate.

Section 615. - SIDEWALKS, DRIVE PADS, AND PAVED MEDIANS

(Labor 40-50 percent)

Use time, materials, and equipment estimate.

Section 617. - GUARDRAIL

(Contract Item)

Use $50-$100 per lineal foot (installed). Cost includes posts on 6'3" centers and regular sections.

Add 20 % to unit price for curved rail sections.

Estimate about $1000 - $3000 each for end anchorage or terminal sections based on type of system used.

Add 40 % for Rustic guardrail.

Call manufacturer for price quotes on material prices.

When guardrail is required on both sides of the roadway, include the total length of rail on both sides.

The length of the rail is determined by measuring the length necessary where it is installed adjacent to the road shoulder, and not from the road centerline length. Also, the length of guardrail is determined by slope distance, not horizontal distance.

Section 618. - CONCRETE BARRIERS AND PRECAST GUARDWALLS

(Contract Item)

Concrete barriers (Jersey) will cost about $45-$60 per lineal foot installed.

Call manufacturer for price quotes on material prices.

Section 619. - FENCES, GATES AND CATTLE GUARDS

Fences and gates being built for campgrounds and rights-of-way use Section 619. For road closure devices use Section 640 Road Closure Devices.

Fences: (Labor 60 percent) Four strand barbed wire

Estimate by time, equipment and material. Costs average about $4.00/LF.

Gates: (Labor 15 percent metal gates, 65 percent wire gates)

Type	Cost Range (ea.)
Metal (double lane)	$2000 - $4000
Metal (single lane)	$1500 - $2000
Wire	$100 - $200
Powder River ™	$300 - $500

Cattleguards: (Labor 10 percent)

Costs range from $4,000 to $6,000 for **16'-0"** width cattle guard. Price include wings and base. Check with supplier for current cost and estimate installation using time and equipment based on actual installation site.

Cattleguard, Steel Decked with HS20-44 Loading Cost Adjustment Factors				
12'-0"	**14'-0'**	**16'-0"**	**24'-0"**	**28'-0"**
0.75	0.9	1.0	1.5	1.75

Note: Precast concrete base weighs 5,250 pounds/side (2,381 kg/side). Ensure appropriate equipment for hauling and unloading is included.

Section 621. - MONUMENTS AND MARKERS

(Labor 25 percent)

Estimate by time, equipment, and material.

Section 622. - RENTAL EQUIPMENT

Equipment rental includes the equipment rate and the operator rate. Equipment rates can be found in the "Equipment Rates" Section. Operator rates can be found in the "Labor Rates" Section. The cost of moving most equipment to the job is included in Section 151 - Mobilization

Section 624. - TOPSOIL

(Labor 50 percent)

Topsoil needed on disturbed areas of backslopes and fillslopes to establish vegetation will be estimated from a known source before the contract is awarded. Include the following in cost estimates:

- Loading costs - Use time and equipment.
- Spread - Use time and equipment.
- Haul - see Haul Section in Clearing and Earthwork.
- Clearing and development of pit area - see Section 641.

The cost of pit development must be included if Section 641 is not included. Elements to consider are move-in costs of equipment needed to clear pit area, cost of clearing and disposal, shaping-up of pit after use, planting and seeding after use, purchase price for topsoil on other than USFS land, etc.

Section 625. - TURF ESTABLISHMENT

(Labor: Dry Method = 30-40%, Dry Method W/Mulch = 60%, Hydraulic Method=40-50%)

Note: The costs for seeding and fertilizing are based on applying seed and fertilizer in one application. There are no allowances in the costs for watering or compacting the seedbed. If you include these requirements an additional allowance will have to be made.

Seeding Method	$/acre
Dry	$450
Hydraulic	$2800

Cost of fertilizer, where required, should be included in the base item. Fertilizer, Section 625.06, should be used only for supplemental applications.

If native grass Seed is required, get a quote from a supplier.

Section 629. - ROLLED EROSION CONTROL PRODUCTS AND CELLULAR CONFINEMENT SYSTEMS

Costs for erosion control blankets and netting materials range from $2 to $4 per SY.

Section 633. - PERMANENT TRAFFIC CONTROL

(Labor 60 percent)

Prices are for estimating only. Call for quotes.

Materials	Material Cost
Wood Post	$1 to $3/LF
Steel u-channel post (3 lbs./ft)	$4.90/LF
Signs	$100 to $200/ea
Route Markers	$20 to $30/ea
Aluminum Sign Panels	$20/Sq Ft
Fiberglass Sign Panels	$20/Sq Ft
Wood Sign Panels	$20/Sq Ft
Regulatory/Warning Signs	$170 to $225/ea
Sign and Post(s)	$125 to $300/ea
Delineators w/ posts	$15 to $25/ea
Delineator only Double Sided	$10 ea

Installation Only*	Price (ea.)
Sign and Post (one)	$35-$60

*Costs must be increased if sign posts are to be installed in rocky fills or other situations requiring difficult excavation.

Section 634. - PERMANENT PAVEMENT MARKINGS

(Contract Item)

Call local suppliers for current materials cost or local contractors for a project specific estimate.

Costs can be estimated on the basis of the gallons of paint required including the cost of glass beads, paint, cleaning surface to be painted, application, and protection of markings until dry. See Standard Specification, FP-03, Section 634 for application rates for paint and beads.

Rough estimate is that an average two-lane road will require $1,600 to $2,000 per mile to do all customary striping work.

Estimator should use designed lengths of single solid, single dashed, and double solid to make estimate; or time, equipment, and materials.

Campground and parking area striping will cost more due to the short lengths, intermittent markings, and tighter working areas.

Section 640. - ROAD CLOSURE DEVICES

(Labor: Metal Gates - 15 percent, Concrete Barriers - 10 percent, Guardrail Barriers - 30 percent)

Type	Cost Range (ea.)
Metal (double lane)	$3500 - $5000
Metal (single lane)	$2500 - $3500
Concrete Barriers	Estimate by time, equipment and material. Call for quotes.
Guardrail Barriers	Estimate by time, equipment and material. Call for quotes.

Signs should be estimated under Section 633.

Section 641. - DEVELOPMENT OF PITS AND QUARRIES

(Labor percent and reduction as per sections used in estimating)

Clearing, grubbing, and slash clean-up should be estimated as recommended for Section 201, include additional allowance for difficult terrain.

Access roads may be estimated as lump sum based upon equipment and labor hours or unit prices for construction items as covered in Section 204. Pay particular attention to materials and terrain encountered in access road construction that will affect cost of construction.

Quarry stripping, slope rounding, restoration, and clean-up should be estimated as lump sum based upon equipment and labor hours or unit prices for construction items as covered in Section 204.

Turf establishment may be estimated per instructions in Section 625.

Ground and traffic control estimated per requirements in Section 635.

If Section 641 is not included in the contract, development costs should be incidental to the items requiring the pit or quarry. Estimator should pay close attention to requirements shown on the pit development plan, and R-1 supplements to FSH 7109.21 (Geotechnical & Materials Engineering Handbook).

Section 660. - TIMBER CROSS DRAINS

(Labor 30 percent)

Designer and estimator are reminded that extreme caution is warranted for designing and/or use of open-top culverts due to relatively high initial costs and potential maintenance problems.

Open-tops are not recommended for surfaced roads, particularly Traffic Service Level A through C roads. Use on low-standard roads where nothing else is practical on a short-term basis may be warranted. Costs nearly equal conventional PE or metal culverts including catch basin construction over the long-term.

Drainage deflectors with rubber belting have usually proven to be better than open-tops for diverting water off the road surface on steeper grades. They generally require less maintenance, except on heavily traveled roads where the belting needs replacement on a periodic basis. The in-place cost of these deflectors is about the same as cost per foot of an 18" installed CMP, plus riprap for slope protection if required.

End of Division 600 Incidental Construction

EQUIPMENT RATES

EQUIPMENT RATES

The figures shown in this section are for equipment rates only. Operator rates are not included but can be found in the labor rates section. The equipment rates include fuel, oil, lubrication, repairs, maintenance, and insurance. The cost of moving most equipment to the job is included in Section 151 - Mobilization. *Profit and overhead charged to equipment are included herein (16 percent).*

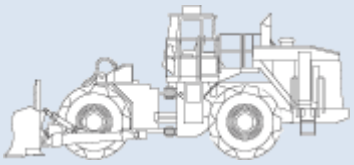
The rates shown herein were derived from the *Rental Rate Blue Book For Construction Equipment*. The models shown should be considered typical and their rates can be applied to similar equipment. Under most situations, the estimator should use the equipment rates listed for equipment that is 15 years of age with compatible production rates. Equipment rates for equipment that is 5 years of age may be used when it is expected to be used for the work being estimated. Local rates should be used if local equipment is generally available at a rate different than those shown herein.

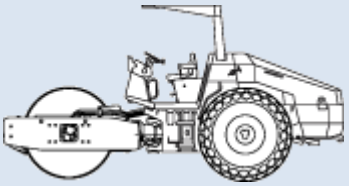
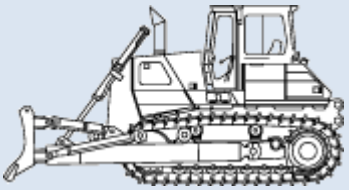
For rates not shown in Table 622, estimator should refer to *Blue Book* equipment rates and correct procedures for age and location factors. For work lasting 40 hours or less, the base rate is determined by dividing the *Blue Book* daily rate by eight. For work lasting over 40 hours, the base rate is determined by dividing the Blue Book monthly rate by 176. The rates shown herein (Table 622) are for work in excess of 40 hours.

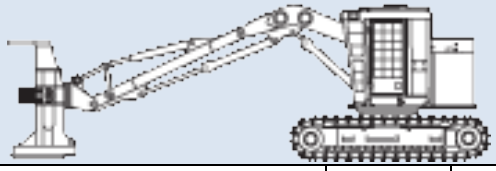
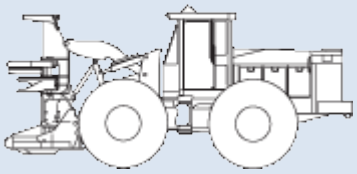
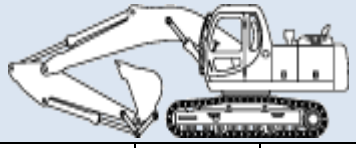
Location factors from the Blue Book have been applied to the rates in Table 622. They reflect the variations between National averages and local conditions caused by the differences in topography, construction seasons, and the costs of labor, freight, taxes, etc. The location factor used was for Montana.

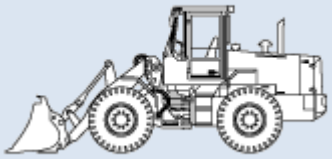
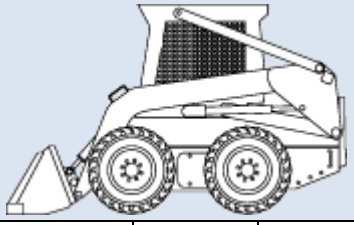
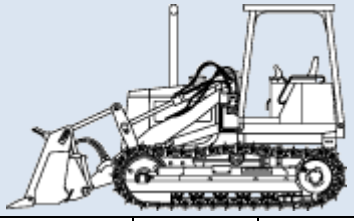
The use of brand names is for the ease of identification of the type and size of equipment and does not constitute an endorsement of any product. Some models listed are no longer manufactured or were not manufactured during the time period under which they are classified.

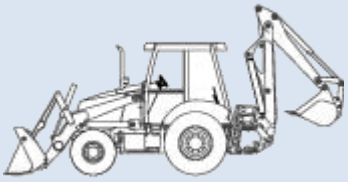
Table 622. Equipment Rates (Cost/Hr WITHOUT Operator)
2011 Rental Rate Blue Book +10% overhead + 6 % profit

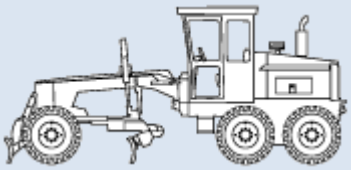
Equipment Class and Description	Age 5	Age 15
Air Equipment		
Air Track Drill		
Atlas Copco CM345/VL140, 4" hole size, Drill Type: Drifter	$51.60	$48.30
Atlas Copco LM100A/YD90, 2-1/2" hole size, Drill Type: Drifter	$54.20	$50.70
Hand-Held Pavement Breaker		
60-65 lbs	$1.20	$1.10
Pneumatic Impact Beaker		
Kent KB-2600 Air Ram, 2000flbs, 600 bpm	$14.50	$14.00
Portable Rotary Screw Air Compressor		
Diesel, 100psi, 100 cfm, 32 HP	$10.60	$10.60
Diesel, 100psi, 160 cfm, 60 HP	$16.00	$16.00
Diesel, 100psi, 450 cfm, 150 HP	$38.40	$38.30
Diesel, 125psi, 375 cfm, 115 HP	$30.50	$30.50
Diesel, 150psi, 600 cfm, 275 HP	$63.20	$63.10
Compaction Equipment		
Hand-Held Rammer		
Gasoline, 3180 lbs/blow, Shoe Size: 4"-13", 4 HP	$5.50	$5.30
Hydraulic Compactor for Backhoe Mounting		
Allied 9700C W/Swivel, 13400lbs, 2000 cycles/minute	$11.70	$11.30
Self Propelled Pad Foot Compactor 		
Dynapac CT262, Diesel, Wheel size: 60"x39", Powershift transmission, 215 HP	$138.30	$133.90
Self Propelled Pneumatic Campactor 		
Caterpillar PS-150C, 2.4MTons, Diesel, 9 wheels, 2/2 speeds, 96 HP	$53.20	$51.80
Hypac C550H, 3.5MTons, Diesel, 9 wheels, 3F/3R speeds, 99HP	$82.00	$79.70

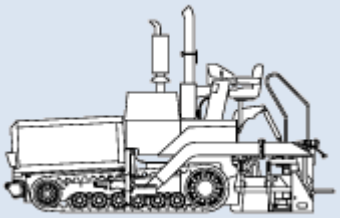
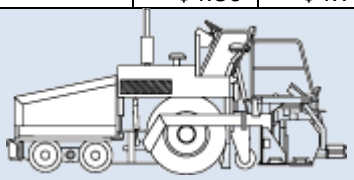
Equipment Class and Description	Age 5	Age 15
Single Drum Vibratory Compactor 		
Caterpillar CP-323C, 3-4.9MTons, Diesel, Drum Type: Padfoot, Drum Width: 50", 80 HP	$40.10	$38.70
Towed Pneumatic Compactor		
Hercules PT-9, 9.6tons, 9 wheels	$16.70	$16.30
Towed Steel Drum Static Compactor		
Hercules GTD 5496, 2 drums, Drum Type: Grid	$19.70	$19.00
Dozer		
Crawler Tractor Multi-Shank Rippers		
130-189 HP, Parallelogram, 3 Shanks	$10.60	$10.00
260-359 HP, Parallelogram, 3 Shanks	$26.40	$24.80
Standard Crawler Dozer 		
Caterpillar D3G XL, Diesel, Rollover Protection Structure (ROPS), Dozer Type: Variable Pitch Angle and Tilt (VPAT), 70 HP	$51.50	$50.00
Caterpillar D4G XL, Diesel, ROPS, Dozer Type: VPAT, 80 HP	$57.70	$56.10
Caterpillar D5N XL, Diesel, Enclosed Rollover Protection Structure (EROPS), Dozer Type: VPAT, 120 HP	$78.70	$76.40
Caterpillar D6N DS XL, Diesel, EROPS, Dozer Type: VPAT, 150 HP	$104.90	$101.60
Caterpillar D7R DS Series II, Diesel, EROPS, Dozer Type: Semi-U, 240 HP	$159.00	$153.90
Caterpillar D8T, Diesel, EROPS, Dozer Type: Semi-U, 310 HP	$218.70	$211.30
Caterpillar D9T, Diesel, EROPS, Dozer Type: Semi-U, 405 HP	$289.90	$280.40
Deere 450J LT, Diesel, ROPS, Dozer Type: PAT, 77 HP	$55.30	$53.70
Deere 550J LT, Diesel, ROPS/Falling Object PS (FOPS), Dozer Type: PAT, 85 HP	$62.10	$60.30
Deere 750J LGP, Diesel, ROPS, Dozer Type: PAT, 155 HP	$102.10	$99.10
Deere 850J LT, Diesel, ROPS, Dozer Type: PAT, 185 HP	$119.60	$115.80
Distributors		
Asphalt Distributors For Truck Mounting		
Power Mode: PTO, 1600 Gallon, Includes Burners, insulated tank, and circulating spray bar; propane fuel cost not included.	$33.20	$31.60

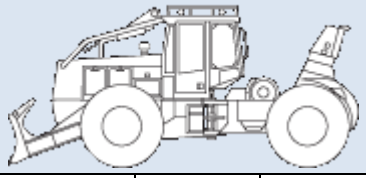
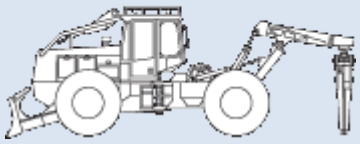
Equipment Class and Description	Age 5	Age 15
Power Mode: PTO, 2000 Gallon, Includes Burners, insulated tank, and circulating spray bar; propane fuel cost not included.	$33.60	$31.90
Power Mode: PTO, 3100 Gallon, Includes Burners, insulated tank, and circulating spray bar; propane fuel cost not included.	$37.20	$35.40
Feller Bunchers		
Crawler Mounted Feller Buncher 		
Deere 703G, Diesel, 181 HP	$169.60	$161.90
Wheel Mounted Feller Buncher 		
Deere 643J,Diesel, Hydrostatic, 2-spd Transmission, 174 HP	$143.10	$138.20
Hydraulic Excavators		
Crawler Mounted 		
Caterpillar 311C U, Diesel, 12 MTon, Bucket Cacacity - Heaped: 0.39cy, 79 HP	$57.50	$55.20
Caterpillar 312C L, Diesel, 13.14 MTon, Bucket Cacacity - Heaped: 0.68cy, 99 HP	$66.00	$63.40
Caterpillar 320C L, Diesel, 21 MTon, Bucket Cacacity - Heaped: 1.25cy, 138 HP	$107.40	$103.10
Caterpillar 325C L, Diesel, 28.6 MTon, Bucket Cacacity - Heaped: 1.5cy, 186 HP	$126.60	$121.80
Caterpillar 330C L, Diesel, 35.1 MTon, Bucket Cacacity - Heaped: 2.25cy, 244 HP	$152.10	$146.50
Deere 120C, Diesel, 13.08 MTon, Bucket Cacacity - Heaped: 0.78cy, 89 HP	$68.00	$65.30
Deere 200C LC, Diesel, 20.9 MTon, Bucket Cacacity - Heaped: 1.12cy, 141 HP	$93.60	$90.10
Hitachi ZAXIS 200LC, Diesel, 20.6 MTon, Bucket Cacacity - Heaped: 1.12cy, 147 HP	$94.50	$91.10

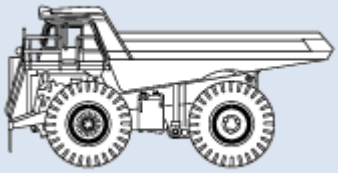
Equipment Class and Description	Age 5	Age 15
Hitachi ZAXIS 270LC-3, Diesel, 28.6 MTon, Bucket Cacacity - Heaped: 1.75cy, 188 HP	$129.90	$124.80
Komatsu PC120-6, Diesel, 12.03 MTon, Bucket Cacacity - Heaped: 0.62cy, 89 HP	$63.00	$60.50
Komatsu PC160LC-7, Diesel, 16.6 MTon, Bucket Cacacity - Heaped: 0.85cy, 115 HP	$83.00	$79.80
Komatsu PC200-7, Diesel, 20.01 MTon, Bucket Cacacity - Heaped: 1.00cy, 143 HP	$89.70	$86.50
Komatsu PC220LC-8, Diesel, 24.9 MTon, Bucket Cacacity - Heaped: 1.57cy, 168 HP	$123.20	$118.40
Komatsu PC270LC-8, Diesel, 30.1 MTon, Bucket Cacacity - Heaped: 1.85cy, 187 HP	$136.80	$131.40
Loaders		
 **4WD Articulated Wheel Loader**		
Case 21E, Diesel, Bucket Cacacity - Heaped: 0.92cy, EROPS, 50 HP	$30.50	$29.60
Caterpillar IT28G, Diesel, Bucket Cacacity - Heaped: 2.35cy, EROPS, 143 HP	$54.00	$52.40
Caterpillar IT38G Series II, Diesel, Bucket Cacacity - Heaped: 3.5cy, EROPS, 160 HP	$67.30	$65.20
Komatsu WA250-5, Diesel, Bucket Cacacity - Heaped: 3.0cy, EROPS, 134 HP	$52.40	$50.90
 **Skid Steer Loader**		
Bobcat 463, Diesel, 700lbs operating capacity, 22.5 HP	$18.80	$18.40
Bobcat S130, Diesel, 1300lbs operating capacity, 49 HP	$28.30	$27.80
 **Standard Crawler Loader**		
Caterpillar 939C, Diesel, Bucket Capacity: 1.5cy, ROPS, 90 HP	$60.90	$58.90

Equipment Class and Description	Age 5	Age 15
Caterpillar 953C, Diesel, Bucket Capacity: 2.42cy, ROPS, 128 HP	$98.60	$95.10
Caterpillar 963C, Diesel, Bucket Capacity: 3.2cy, ROPS, 158 HP	$128.40	$124.00
 **Tractor-Loader-Backhoe**		
Case 580 Super M Series 2, Diesel, 2WD, Digging Depth < 15', Loader Bucket Cacacity - Heaped: 1.00cy, Extendable Backhoe Stick, ROPS, 90 HP	$41.40	$40.20
Case 580 Super M Series 2, Diesel, 4WD, Digging Depth < 15', Loader Bucket Cacacity - Heaped: 1.00cy, Extendable Backhoe Stick, ROPS, 90 HP	$43.70	$42.30
Deere 310G, Diesel, 2WD, Digging Depth < 15', Loader Bucket Cacacity - Heaped: 1.00cy, Extendable Backhoe Stick, ROPS/FOPS, 70 HP	$35.10	$34.00
Miscellaneous Equipment		
Chain Saw		
Gasoline, 3cu.in., 20" bar length	$2.50	$2.50
Cordless Dril		
Electric, Variable 2-spd, Rev., 370/1000 RPM, 0.5-inch	$0.80	$0.80
Enclosed Horizontal Motor		
1200 RPM, 460/575 Volts, 100 HP	$7.00	$6.90
1200 RPM, 460/575 Volts, 25 HP	$1.90	$1.90
Heavy Duty Centrifugal Pump		
Diesel, 18M CPB Rating, 3-inch, 18000 gph, 10 HP	$8.30	$8.20
Diesel, 40M CPB Rating, 4-inch, 40000 gph, 45 HP	$21.70	$21.50
Gasoline, 20M CPB Rating, 3-inch, 20000 gph, 18 HP	$13.50	$13.40
Gasoline, 8M CPB Rating, 2-inch, 9600 gph, 9 HP	$9.70	$9.60
Large Generator Set		
Diesel, 150 kW, Open Enclosure, 240 HP	$69.00	$68.80
Diesel, 300 kW, Open Enclosure, 400 HP	$113.70	$113.30
Diesel, 60 kW, Open Enclosure, 88 HP	$30.50	$30.30
Diesel, 90 kW, Open Enclosure, 130 HP	$40.40	$40.20
Pressure Washer Hot		
Gasoline, 4 gpm, 1000 psi, Portable, 8 HP	$8.90	$8.60
Gasoline, 5 gpm, 3000 psi, Portable, 16 HP	$11.60	$11.10
Rotary Mower		
PTO, Type: Rotary(Rear mounted), 10ft Blade, 90 HP	$16.00	$15.30
PTO, Type: Rotary(Side mounted), 5.5ft Blade, 50 HP	$12.90	$12.40
Rubber Tired Brush Cutter		
Hydo-Ax 621E, Diesel, 8ft Cutter, 177 HP	$148.50	$142.00

Equipment Class and Description	Age 5	Age 15
Seed Sprayer for Truck Mounting		
Reinco HG-10GX, Gasoline, 1250 Gallon, 34 HP	$17.40	$16.90
Small Generator Set		
Gasoline, 1000 w, 3.5 HP	$2.50	$2.50
Gasoline, 3000 w, 8 HP	$4.30	$4.30
Suction Hose		
2-inch, 25 ft	$0.20	$0.20
3-inch, 25 ft	$0.30	$0.20
4-inch, 25 ft	$0.30	$0.30
Towed Mower		
PTO, Type: Flail, 7ft Blade, 55 HP	$5.90	$5.50
Trailer Mounted Brush Chipper		
Bandit 150XP, Diesel, 12-inch, 125 HP	$45.80	$44.40
Trailer Mounted Mucher		
Reinco M90, Diesel, 20 tph, 115 HP	$36.70	$35.70
Trailer Mounted Mulcher		
Gasoline, 5 tph, 35 HP	$13.80	$13.40
Truck Scale		
Steel Deck, 60 ton, 70'x10'	$20.30	$19.80
Walk-Behind Chain Trencher		
Ditch Witch 1820, Gasoline, 3.25-inch Trench Width, 48-inch Trench Depth, 17.5 HP	$12.20	$11.90
Motor Graders		
Articulated Frame Grader 		
Caterpillar 120H, Diesel, ROPS, 12' Moldboard, 125 HP	$61.30	$59.20
Caterpillar 140H, Diesel, ROPS, 12' Moldboard, 165 HP	$92.00	$88.60
Caterpillar 14H, Diesel, ROPS, 14' Moldboard, 220 HP	$124.60	$119.50
Caterpillar 16H, Diesel, ROPS, 16' Moldboard, 285 HP	$165.90	$159.40
Deere 770G, Diesel, EROPS, 12' Moldboard, 165 HP	$84.50	$81.50
Grader Rear Ripper/Scarifier		
185 HP and over, 3, Shanks	$11.30	$10.60
upto 180 HP, 3 Shanks	$6.70	$6.40

Equipment Class and Description	Age 5	Age 15
Paving & Chip Sealing Equipment		
 **Crawler Mounted Asphalt Paver**		
Caterpillar AP-655C, Diesel, Screed Model: 8-16B Extend-A-Mat, 158 HP	$273.30	$266.60
Lee-Boy 1000F, Diesel, Screed Model: Legend (8'-15' width), 44 HP	$51.00	$49.90
Pull Type Pavement Broom		
Drive Type: Engine, 84-inch broom length, 20 HP	$15.70	$15.00
Self Propelled Chip Spreader		
Rosco SPR-H, Diesel, 10ft Spreader Hopper, 152 HP	$99.60	$96.40
Self Propelled Pavement Broom		
Diesel, Hydrostatic Transmission, 96-inch broom length, 80 HP	$29.10	$28.50
Towed Chip Spreader		
Gasoline, w/ Chain Conveyor, 7ft Spreader Hopper, 7 HP	$4.80	$4.70
 **Wheel Mounted Asphalt Paver**		
Barber-Greene BG-240C, Diesel, 2WD, Screed Model: Pavemaster 10B (fixed width 10'), 139HP	$219.40	$214.60
Lee-Boy 1000F, Diesel, Screed Model: Legend (8'-15' width), 37 HP	$68.10	$66.80
Vogele 2111W, Diesel, 4WD, Screed Model: HR400D, 110HP	$189.70	$185.10
Rock Crushing Equipment		
Cone Crusher		
Electric, Cone Type: Standard, Head Size:45", 125 HP required	$56.50	$53.50
Double Deck Portable Screening Plant		
Gasoline, Screen Width: upto 36", Screen Size: 3'x6', Conveyor Size: 30"x60', 60 HP	$49.70	$48.60
General Purpose Portable Belt Conveyor		
Diesel, upto 23" Belt Width, Convery Size: 18"x30', 150tph, 40 HP	$23.70	$23.10
Gravel Plant		
Piorneer 2036-3024 Duplex, Electric, Roll Crusher Size:30"X24" Triple, Jaw Crusher Size: 20"x36", Screen Size: 48"X14', 295 HP required	$151.50	$145.70

Equipment Class and Description	Age 5	Age 15
Heavy Duty Apron Feeder		
Electric, 3 Chains, Size: 36"X14', 7.5 HP	$31.80	$29.70
Jaw Crusher		
Electric, Gape Sizes: 25"-41", Feed Size: 15"x36", 75 HP	$31.50	$30.00
Radial Stacker		
Diesel, upto 23" Belt Width, Convery Size: 18"x100', 170tph, 38 HP	$39.60	$38.20
Roll Crusher		
Electric, Roll Type: Double, Rotor Size (DxW): 30"x25", 100-200 HP required	$37.60	$35.40
Triple Deck Portable Screen Plant		
Diesel, Screen Width: 37" and over, Screen Size: 5'x10', Coneyor Size: 42"x50', 110 HP	$72.80	$71.00
Skidders		
Wheel Mounted Cable Log Skidder 		
Caterpillar 525B, Diesel, Powershift Transmission, 40300lbs maximum Line Pull, 160 HP	$111.90	$108.80
Deere 540G III, Diesel, Powershift Transmission, 35029lbs maximum Line Pull, 117 HP	$84.80	$82.30
Franklin 405 S2, Diesel, Powershift Transmission, 40000lbs maximum Line Pull, 135 HP	$84.10	$81.80
Wheel Mounted Grapple Log Skidder 		
Caterpillar 525B, Diesel, Powershift Transmission, 49650lbs maximum Line Pull, 120-inch Grapple, 160 HP	$120.00	$116.50
Franklin 405 S2, Diesel, Powershift Transmission, 34000lbs maximum Line Pull, 100-inch Grapple, 135 HP	$94.90	$92.20
Trailers		
Fixed Gooseneck Equipment Trailer		
3 Axles, Drop Deck, 17' Deck Length, 35ton	$18.30	$18.00
3 Axles, Drop Deck, 17'-18' Deck Length, 50ton	$19.30	$18.90
Folding Gooseneck Equipment Trailer		
4 Axles, Drop Deck, 16 tires, 75ton	$28.50	$27.90

Equipment Class and Description	Age 5	Age 15
Off-Highway Bottom Dump Semi-Trailer		
1 Gate, Capacity: 18cy, Payload: 27ton	$12.70	$12.30
Off-Highway Bottom Dump Trailer		
Load King 2030, Capacity: 20cy, Payload: 30ton	$36.30	$36.10
Load King 2842, Capacity: 28cy, Payload: 42ton	$37.50	$37.30
Standard Field Office Trailer		
8'X24'	$2.40	$2.30
8'X24' with Toilet	$2.70	$2.60
Trucks		
 **Mechanical Drive Rear Dump**		
Caterpillar 769D, 36.4 MTons, Diesel, 22.3-31.7cy, 487 HP	$163.30	$157.20
Caterpillar 773E, 54.4 MTons, Diesel, 34.8-46.4cy, 671 HP	$201.90	$194.50
On-Highway Flatbed Truck		
Diesel, 4x2, 15000 maximum gross vehicle weight, 200 HP	$27.00	$26.40
Diesel, 4x2, 25000 maximum gross vehicle weight, 200 HP	$30.30	$29.50
On-Highway Light Duty Truck		
Diesel, 4x2, Conventional Cab, 3/4ton, 160 HP	$14.70	$14.50
Diesel, 4x4, Conventional Cab, 3/4ton, 160 HP	$15.40	$15.20
Diesel, 4x4, Crew Cab, 1ton, 340 HP	$26.10	$25.80
Gasoline, 4x4, Crew Cab, 3/4ton, 285 HP	$27.60	$27.30
On-Highway Rear Dump		
Diesel, 6x4, 40000lbs maximum grouss vehicle weight, 8-10cy, 315 HP	$62.60	$61.00
Diesel, 6x4, 50000lbs maximum grouss vehicle weight, 10-12cy, 400 HP	$78.00	$75.90
Diesel, 6x4, 70000lbs maximum grouss vehicle weight, 12-18cy, 400 HP	$85.30	$82.80
On-Highway Truck Tractor		
Diesel, 6x4, 50000lbs maximum grouss vehicle weight, 310 HP	$64.80	$63.30
Diesel, 6x4, 75000lbs maximum grouss vehicle weight, 400 HP	$77.60	$75.90
On-Highway Water Tanker		
Diesel, 3000 Gallon, 190 HP	$40.60	$39.50
Diesel, 4000 Gallon, 250 HP	$61.50	$59.60
Gasoline, 2000 Gallon, 175 HP	$42.20	$41.30

End of Equipment Rates

LABOR RATES

LABOR RATES (Davis-Bacon + payroll loading + 10 percent OH + 6 percent profit)

Classification	Idaho Area 1 Zone 1	Idaho Area 1 Zone 2	Idaho Area 2 Zone 2	Montana Zone 1	Montana Zone2	Montana Zone 3
General Laborer	$41.32	$43.99	$47.26	$36.27	$39.83	$41.96
Driller, Air Track	$49.64	$52.49	$51.91	$42.26	$46.35	$48.80
Sawyer	$46.13	$49.14	$52.22	$42.98	$47.15	$49.66
Powderman	$45.67	$48.53	$54.77	$43.90	$47.98	$50.43
Tractor Operator (to D6 or equiv)	$47.13	$49.79	$49.58	$42.82	$46.38	$48.51
Tractor Operator (D6 or larger)	$48.08	$50.74	$49.58	$44.04	$47.60	$49.74
Grader Operator	$48.08	$50.74	$49.58	$42.82	$46.38	$48.51
Loader Operator (4 cy and less)	$47.35	$50.01	$49.13	$42.82	$46.38	$48.51
Loader Operator (over 4 cy)	$48.08	$50.74	$49.58	$44.04	$47.60	$49.74
Backhoe Operator (under 3 cy)	$47.72	$50.38	$49.35	$42.82	$46.38	$48.51
Shovel/Hyd Excavator	$48.08	$50.74	$49.58	$44.04	$47.60	$49.74
Lowboy/Semi-Tractor (under 50 ton)	$43.61	$46.27	$48.09	$42.85	$46.41	$48.55
Dump Truck Driver (12 cy and less)	$43.24	$45.90	$47.85	$42.85	$46.41	$48.55
Dump Truck Driver (over 12 cy)	$43.38	$46.04	$48.09	$42.85	$46.41	$48.55
Skidder Cat Operator	$51.56	$54.57	$54.56	$48.57	$52.74	$55.25
Rubber Tired Skidder	$51.80	$54.81	$54.30	$48.57	$52.74	$55.25
Log Loader Operator	$52.62	$55.63	$54.56	$50.01	$54.18	$56.68

PAYROLL LOADING RATE (Social Security + Workers' Comp + Unemployment)

Class Description	*Class*	*Idaho*	*Montana*
Forest Road Constr/Separate Contract	5511	N/A	30.08%
R/W Timber or Forest Road Constr/No Separate Contract	2702	29.76%	43.83%
Surface or Paving Work	5506	16.96%	36.29%
Subsurface Work or Road Constr/Major Road	5507	14.72%	22.76%
Quarry Work	5508	23.23%	40.88%
Crushing Only	1710	17.53%	22.53%
Log Haul	2727	29.76%	30.03%

End of Labor Rates

TEMPORARY ROAD COST ESTIMATING

Cost Estimating for Temporary Roads

The decision to construct temporary roads for a timber sale or other activity is based on transportation planning and resource objectives that are documented in a NEPA decision. Temporary roads generally are built for one or two seasons of use for limited traffic. The National Forest Management Act (NFMA) requires that any temporary road built as part of a timber sale or other permit/lease shall be designed with the goal of reestablishing vegetative cover on the roadway and adjacent disturbed area within ten years after the termination of the contract, permit, or lease. In addition to this NFMA requirement, the timber sale contract requires outsloping, removal of culverts and ditches, and building water bars or cross ditches after the road is no longer needed. Obliteration costs shown in Table T-3 reflect a wide variation in required work.

For timber sales, FSH 2409.18, Section 45.36d, outlines the general procedures for estimating the costs of temporary roads. Temporary road cost estimates shall be based on the data and procedures contained in the current Cost Guide for road construction. The responsibility for the accuracy of temporary road cost estimates rests with the Forest Engineer (FSM 7721.04c). Following the *Cost Estimate Template for Temporary Roads* at the end of this Section is a sample form for documenting temporary road costs estimates.

The following procedure, or an estimate by time and equipment, should be used to develop temporary road costs. If time and equipment methods are used, the estimator should use the labor rates and equipment rental rates (for old equipment) contained in this Cost Guide. The labor rates need to be adjusted per section entitled Davis-Bacon/Purchaser Wage Rate Adjustments which appear earlier in this publication and have the profit of 6% removed.

Step 1: Using Table T-1, determine costs for clearing and grubbing. Enter Table T-1 with State, sideslope (SS%), and right-of-way volume per acre. Move horizontally and read the clearing cost per mile. The cost of felling, bucking, and skidding the right-of-way timber on temporary roads is considered a logging cost and not a road cost. Therefore it is included in the logging costs and not in Table T-1. If additional clearing width is desired for windrow placement, etc make necessary cost allowance.

Step 2: Using Table T-1, determine excavation cost per mile by continuing horizontally on the same line used in Step 1. If turnouts or turn-arounds are desired, adjust excavation costs accordingly.

Step 3: Using Table T-1, determine seeding cost per mile by continuing horizontal on the same line used in Steps 1 and 2. The costs of seeding include the road bed. **NOTE**: seeding costs do not make allowances for native seed, if native seed is required, contact supplier for cost and availability.

Step 4: Determine the cost of obliteration using Table T-3. This item should be included in every temporary road.

Step 5: Total the unit per mile costs determined in Steps 1-4.

Step 6: Multiply unit cost from Step 5 by the length of the temporary road(s).

Step 7: Determine the total cost of drainage structures: Dips: $125 each
Culverts: See Table T-2

Step 8: Add the costs determined in Steps 6 & 7. Add the appropriate allowance for Mobilization (See Table T-4).

Step 9: Remove Profit allowance by dividing the total in Step 8 by 1.06.

Example Temporary Road Calculation:

Location: Idaho
Average side slope: 30 percent
Estimated length: 1.5 miles
Timber volume: 20 MBF/acre
Drainage structures: 3 dips
1 - 18" culvert, slope is 20%
1 - 24" culvert, slope is 20%
Average scarification needed for obliteration

Solution:

Step 1: Clearing and grubbing = $4,040/mile

Step 2: Excavation = $2,270/mile

Step 3: Seeding = $820/mile

Step 4: Obliteration = $1,800/mile

Step 5: (1) + (2) + (3) + (4) = $8,930/mile

Step 6: $8,930/mile x 1.5 miles = $13,395

Step 7: Drainage structures:

3 dips x $125/dip	= $375
1 18" culvert	= $685
1 24" culvert	= $775
	$1,835

Step 8: (6) + (7) = $13,395 + $1,835 = $15,230

Mobilization = $15,230* 0.07 = $1,066

Total = $16,296

Step 9: $16,296/ 1.06 (profit) = $15,370(rounded)

Note: Temporary erosion control measures are not included in above example, refer to Section 157 for additional information. Also, this example did not include truck turnouts, turn-arounds or additional clearing for windrows.

Table T-1
Idaho
Basic Temporary Road Costs

Side Slope %	*R/W Vol/Ac*	*Temporary Road Clearing $/mile*	*Excavation $/mile*	*Seeding 12 ft w/o ditch $/mile*
0	0	$3,440	$1,420	$690
10	0	$3,030	$1,420	$610
20	0	$3,280	$1,650	$690
30	0	$3,740	$2,270	$820
40	0	$4,630	$3,540	$1,020
50	0	$6,810	$5,300	$1,360
0	5	$3,460	$1,420	$690
10	5	$2,990	$1,420	$610
20	5	$3,280	$1,650	$690
30	5	$3,830	$2,270	$820
40	5	$4,820	$3,540	$1,020
50	5	$7,320	$5,300	$1,360
0	10	$3,500	$1,420	$690
10	10	$2,970	$1,420	$610
20	10	$3,290	$1,650	$690
30	10	$3,900	$2,270	$820
40	10	$5,010	$3,540	$1,020
50	10	$7,830	$5,300	$1,360
0	15	$3,520	$1,420	$690
10	15	$2,940	$1,420	$610
20	15	$3,310	$1,650	$690
30	15	$3,970	$2,270	$820
40	15	$5,220	$3,540	$1,020
50	15	$8,340	$5,030	$1,360
0	20	$3,560	$1,420	$690
10	20	$2,910	$1,420	$610
20	20	$3,310	$1,650	$690
30	20	$4,040	$2,270	$820
40	20	$5,410	$3,540	$1,020
50	20	$8,850	$5,300	$1,360
0	25	$3,590	$1,420	$690
10	25	$2,880	$1,420	$610
20	25	$3,320	$1,650	$690
30	25	$4,120	$2,270	$820
40	25	$5,600	$3,540	$1,020
50	25	$9,350	$5,300	$1,360

Table T-1 *(Continued)*
Idaho
Basic Temporary Road Costs

Side Slope %	*R/W Vol/Ac*	*Temporary Road Clearing $/mile*	*Excavation $/mile*	*Seeding 12 ft w/o ditch $/mile*
0	30	$3,620	$1,420	$690
10	30	$2,860	$1,420	$610
20	30	$3,330	$1,650	$690
30	30	$4,190	$2,270	$820
40	30	$5,810	$3,540	$1,020
50	30	$9,860	$5,300	$1,360
0	35	$3,650	$1,420	$690
10	35	$2,820	$1,420	$610
20	35	$3,340	$1,650	$690
30	35	$4,260	$2,270	$820
40	35	$6,000	$3,540	$1,020
50	35	$10,370	$5,300	$1,360
0	40	$3,680	$1,420	$690
10	40	$2,800	$1,420	$610
20	40	$3,340	$1,650	$690
30	40	$4,350	$2,270	$820
40	40	$6,200	$3,540	$1,020
50	40	$10,880	$5,300	$1,360
0	45	$3,710	$1,420	$690
10	45	$2,770	$1,420	$610
20	45	$3,360	$1,650	$690
30	45	$4,420	$2,270	$820
40	45	$6,390	$3,540	$1,020
50	45	$11,390	$5,300	$1,360
0	50	$3,740	$1,420	$690
10	50	$2,750	$1,420	$610
20	50	$3,370	$1,650	$690
30	50	$4,490	$2,270	$820
40	50	$6,600	$3,540	$1,020
50	50	$11,890	$5,300	$1,360

Table T-1
Montana
Basic Temporary Road Costs

Side Slope %	*R/W Vol/Ac*	*Temporary Road Clearing $/mile*	*Excavation $/mile*	*Seeding 12 ft w/o ditch $/mile*
0	0	$3,660	$1,320	$730
10	0	$3,220	$1,320	$640
20	0	$3,490	$1,620	$730
30	0	$3,980	$2,240	$870
40	0	$4,920	$3,490	$1,080
50	0	$7,260	$5,240	$1,450
0	5	$3,720	$1,320	$730
10	5	$3,220	$1,320	$640
20	5	$3,520	$1,620	$730
30	5	$4,090	$2,240	$870
40	5	$5,160	$3,490	$1,080
50	5	$7,830	$5,240	$1,450
0	10	$3,780	$1,320	$730
10	10	$3,220	$1,320	$640
20	10	$3,570	$1,620	$730
30	10	$4,200	$2,240	$870
40	10	$5,400	$3,490	$980
50	10	$8,400	$5,240	$1,450
0	15	$3,840	$1,320	$730
10	15	$3,230	$1,320	$640
20	15	$3,610	$1,620	$730
30	15	$4,310	$2,240	$870
40	15	$5,640	$3,490	$1,080
50	15	$8,970	$5,240	$1,450
0	20	$3,900	$1,320	$730
10	20	$3,220	$1,320	$640
20	20	$3,650	$1,620	$730
30	20	$4,420	$2,240	$870
40	20	$5,870	$3,490	$1,080
50	20	$9,540	$5,240	$1,450

Table T-1 *(Continued)*
Montana
Basic Temporary Road Costs

Side Slope %	*R/W Vol/Ac*	*Temporary Road Clearing $/mile*	*Excavation $/mile*	*Seeding 12 ft w/o ditch $/mile*
0	25	$3,960	$1,320	$730
10	25	$3,220	$1,320	$640
20	25	$3,680	$1,620	$730
30	25	$4,530	$2,240	$870
40	25	$6,110	$3,490	$1,080
50	25	$10,100	$5,240	$1,450
0	30	$4,020	$1,320	$730
10	30	$3,220	$1,320	$640
20	30	$3,720	$1,620	$730
30	30	$4,640	$2,240	$870
40	30	$6,350	$3,490	$1,080
50	30	$10,670	$5,240	$1,450
0	35	$4,090	$1,320	$730
10	35	$3,220	$1,320	$640
20	35	$3,750	$1,620	$730
30	35	$4,750	$2,240	$870
40	35	$6,600	$3,490	$1,080
50	35	$11,250	$5,240	$1,450
0	40	$4,150	$1,320	$730
10	40	$3,210	$1,320	$640
20	40	$3,790	$1,620	$730
30	40	$4,860	$2,240	$870
40	40	$6,840	$3,490	$1,080
50	40	$11,820	$5,240	$1,450
0	45	$4,210	$1,320	$730
10	45	$3,210	$1,320	$640
20	45	$3,840	$1,620	$730
30	45	$4,960	$2,240	$870
40	45	$7,070	$3,490	$1,080
50	45	$12,390	$5,240	$1,450
0	50	$4,270	$1,320	$730
10	50	$3,210	$1,320	$640
20	50	$3,880	$1,620	$730
30	50	$5,070	$2,240	$870
40	50	$7,310	$3,490	$1,080
50	50	$12,960	$5,240	$1,450

Table T-2
Culverts

Side Slope %	*Diameter (Inches)*	*Length (Feet)*	*$/ft*	*$/culvert*
0	18	20	$23.51	$ 475.00
10	18	26	$23.53	$ 615.00
20	18	28	$24.37	$ 685.00
30	18	32	$25.34	$ 815.00
40	18	52	$26.34	$1,370.00
50	18	60	$27.42	$1,650.00
60	18	80	$30.56	$2,450.00
Side Slope %	*Diameter (Inches)*	*Length (Feet)*	*$/ft*	*$/culvert*
0	24	20	$ 26.78	$ 540.00
10	24	26	$ 26.86	$ 700.00
20	24	28	$ 27.56	$ 775.00
30	24	32	$ 28.48	$ 915.00
40	24	52	$ 29.54	$1,540.00
50	24	60	$ 30.69	$1,845.00
60	24	80	$ 33.84	$2,710.00

Table T-3
Obliteration of Temporary Roads

Description	*Terrian*	*$/Mile*
Surface scarification, outslope, revegetation	Gentle	$625 - $875
Scarification, CMP removal, outslope, waterbars, rounding of backslopes and revegetation	Moderate	$1,060 - $2615
	Steep	$1550 - $3300
CMP removal, recontouring, and revegetation	Gentle	$2350 - $4600
	Moderate to Steep	$3,300 - $6500

Note: Davis-Bacon/Purchaser Wage Rate Adjustment has been made for above costs. Obliteration requirements are highly variable, ranging from surface scarification and water bar placement to complete recontouring and revegetation of the former roadway. Costs may increase due to difficult or unique conditions. Costs shown above based on small dozer, excavator and sawyer.

Table T-4
Mobilization for Temporary Roads

Idaho: 7.0%
Montana: 7.0%

The following is an example form to be used when costing estimating for temporary roads.

Cost Estimate Template for Temporary Roads

Sale Name _____ Made by _____

Unit or Road No. _____ Checked by _____

Reference: Cost estimating procedures for temporary roads from

Cost Guide - pages _____

Average Side Slope:

Length: _____ ft. = _____ Miles

Timber Volume: _____ MBF/Acre

Drainage Structures: _____ Dips

_____ 18" CMP, _____ 24" CMP

Note: Do not adjust project costs for inflation or deflation.

Step 1: Clearing and Grubbing (Table T-1) = $ _____ /Mile (1)

Step 2: Excavation (Table T-1) = $ _____ /Mile (2)

Step 3: Seeding (Table T-1) = $ _____ /Mile (3)

Step 4: Obliteration (Table T-2) = $ _____ /Mile (4)

Step 5: Total Unit Cost = (1)+(2)+(3)+(4) = $ _____ /Mile (5)

Step 6: Basic Cost = Total (5) x Length = $ _____ /Mile x _____ Mile(s) = $ _____ (6)

Step 7: Drainage Structures

_____ dips x $ _____ /Dip = $ _____

_____ 18" CMPs x $ _____ /CMP = $ _____

_____ 24" CMPs x $ _____ /CMP = $ _____

Drainage Cost Total = $ _____ (7)

Step 8: Subtotal = Basic Cost (6) + Drainage Cost (7) = $ _____

Mobilization = Subtotal x Mobilization% = $ _____ x _____ % = $ _____

Subtotal + Mobilization = $ _____ (8)

Step 9: TOTAL COST = (8) / Profit = $ _____ / 1.06 = $ _____ (9)

End of Temporary Road Cost Estimating